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FIRST PART.

ORIGINAL ARTICLES

The Organisation of the Agricultural Department in the Belgian Congo.

BY

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Agricultural Engineer at the Belgian Colonial Office.

There has been an agricultural department working in the Belgian Congo for some 15 years, but it was only 2 years after Belgium had retaken the Colony (1908) that the department was organised according to the principles holding in the large modern colonies.

M. T. RENKIN, Minister for the Colonies, confided the organisation to M. LEPLAE, Professor of Colonial Agriculture in the University of Louvain, who had studied the special conditions of colonial agriculture in several colonies in the tropics. At his request several members of the agricultural staff were sent to various foreign colonies in order to gain special experience: their chief stays were made in Ceylon, Java and Sumatra, Malaya, South Africa and British and German East Africa.

New laboratories and experimental centres were founded and fully equipped for the study of plant and animal diseases. The best of the existing experimental stations were developed. Finally, the general agricultural equipment was completed, chiefly by the despatch of steam cultivators and machines for the treatment of coffee, rice, cotton, fibres, etc.

A Publication was begun of a quarterly periodical known as the *Bulletin agricole du Congo belge.*

The agricultural programme distinctly favoured scientific and practical resarch.

After only 5 years' experience of this system it is already perfectly clear that all new progress must be along methodical and prudent lines and that as much useful information must be obtained as possible to serve as basis for that progress.

In a country as new as the Belgian Congo, it is obvious that, along with favourable factors, numerous difficulties and problems must arise, the solutions to which can only be obtained by investigations conducted in accordance with modern science progress.

Research Laboratories.

The Colony possesses at the present moment 5 laboratories well equipped for scientific research on any agricultural problems which may be submitted to them by the various colonies or which the Directors of the laboratories may consider of general interest.

Two *Laboratories of Agricultural Chemistry and Plant Physiology* are at work, one at Zambi (Lower Congo), the other at Elisabethville (Katanga). Their researches for many years past have been directed exclusively towards the study of the agricultural soils of the colony.

A *Laboratory of Agricultural Mycology* is attached to the Eala Botanical Garden. The Director is M. Vermoesen. D. Sc. who was sent to the British and Dutch Indies in order to study the diseases of colonial plants and the modern scientific methods for their control.

The mycologist visits the State plantations and also, on request those of private individuals where there is any outbreak of disease. He then prescribes such measures of control as seem advisable and may even make their adoption obligatory by means of bye-laws.

The first subject to receive attention has been the treatment of fungoid diseases of cacao and coffee. Other researches have also been made, particularly that on *Fomes semitostus*, a fungus distributed throughout equatorial countries and which attacks the roots of Hevea.

The *Laboratory of Agricultural Entomology* has hitherto been situated in the Eala Botanical Garden. The Director is Mr. Mayne, who has carried out some very interesting work on insects attacking cacao, coffee and rubber plantations.

The results obtained by the departments of mycology and entomology are published regularly in the *Bulletin agricole du Congo belge* and in the *Etudes de Biologie agricole*.

The following works have been published :

Sahlbergella singularis (Hagl.) producing canker of cacao (*Bull. Agr.*, Vol. V, No. 2).

Stephanoderes coffeae, (Haged) injurious to coffee (*Bull. Agr.*, Vol. V, No. 4).

Papilio demoleus attacking species of *Citrus* (*Bull. Agr.*, Vol. V, No. 4).

The pests of *Hevea* (*Bull. Agr.*, Vol. V, No. 4).

On the Oviposition of *Sahlbergella singularis* (*Bull. Agr.*, Vol. V, No. 1-2),

A *Laboratory of Veterinary Bacteriology* was attached in 1912 to the Stock Breeding Station at Zambi. The Director is M. Neefs, veterinary surgeon in the Belgian Army, who completed his studies in the tropical laboratories of Nairobi (British East Africa) and Pretoria (Transvaal).

The Zambi Stock-breeding station offers exceptional facilities for the study of animal diseases. Every kind of domestic animal is kept and raised, forming important herds, including numerous varieties imported from various regions of the globe.. Among these are horned cattle from Angola, Ceylon (Zebus), Dahomey, Belgium; horses from Senegal, Java, Russia and Belgium : asses from Sicily and other parts of Italy, Poitou and Senegal, etc. The Station is situated close to the important breeding centre of Matebbe (4000 head).

The chief efforts of the Bacteriological Laboratory have been devoted to the study of the diseases most frequently encountered in the Colony: trypanosomiasis, various skin diseases (mange, scab, etc.), pneumonia, piroplasmosis, etc.

Experimental Stations.

A. — Field Crops — Preliminary experiments in cultivation in the ild countries of Central Africa invariably involve high expense and al- ost always distinct set backs. It is only rarely that the individual olonists and even the Agricultural Societies themselves possess the ne- ssary resources to enably them to undertake such costly research with- ut considerable danger. The Belgians owing to their total lack of ex- erience of colonial agriculture, were particularly handicapped from this oint of view. The experimental work was consequently undertaken by he State.

The primary object of the Experimental Stations of the Belgian ongo was to show the material possibility of various kinds of crops and anches of breeding When this first result has been achieved it is abso- utely necessary, from the practical point of view, to show that these particu- ar undertakings are capable of yielding an adequate return and that they eserve the attention of agriculturists and of companies working planta- ions.

Eala Botanical Garden. — The Eala establishment, comprising a bo- anical and an experimental garden was founded in 1890, on the banks of he Kuki river exactly on the Equator, where it was placed on the advice f Prof. Emile Laurent. Situated in a warm region with regular rainfall, he Eala Botanical Garden is particularly well adapted to the study and ropagation of equatorial plants. It now contains a great number of ecies and varieties of which 600 are indigenous to the Congo and forms scientific centre of acknowledged reputation.

The Experimental Garden contains about 200 plots devoted to econo- mic and ornamental plants.

The fact that the laboratories of mycology and entomology belonging the colony are also situated at Eala has already been noted.

An apartment with work-room attached is reserved for foreign bo- nists who intend working on the flora of Central Africa.

Experimental Farm of Munama (Katanga). Experiments of great in- rest are carried out on this farm wih the view of establishing practical

methods for the conservation of the fertility of Katanga soils, and also for showing the farming colonists established in the mining region the means of increasing the returns from the cultivation of the best paying kinds of crops The experiments are also directed to the improvement of soils by means of chemical manures and irrigation.

The results obtained at Munama, under the direction of M. ROMMELAERE, have already considerably aided the solution of the big farming problems set by the nature of the Katanga soils and by the presence of the tsetse fly, which renders the use of draught animals impossible for initial clearing and for the first few years' work of cultivation.

Irrigation, green manuring, the keeping of cattle permanently stabled and the use of wood ash have already been instrumental in securing bumper crops. At the present moment the Station is studying the question of lowering the cost of production by the use of machines.

The remaining Stations have specialised as much as possible in research and experimental work on a single class of crop or on a single class of breeding. An account of these is given below.

Cacao. — Numerous plantations of cacao had been established in the equatorial zone by the independent State, but since the work of reorganisation, experiments on the cultivation of this crop are carried on only at the Station of Barumbu (Aruwimi). This plantation is nearly 20 years old but it had been badly looked after and rapidly deteriorated when the new Department of Agriculture took it over in 1911. It then contained 75 000 plants of cacao, 35 000 of which were in too poor a state to survive. The remaining 35000, however, soon repaid the work of careful cultivation and once the plantations had been put on a sound footing they developed vigorously. The plantation is now a splendid one and gives a profit estimated at one million francs.

Experiments have proved that the cultivation of cacao, with proper management, is very remunerative in the region of the Upper Congo, the central region being perfectly adapted to this crop.

Barumbu cacao sells on the London market at very high prices which the Agricultural Department hopes to see still further increased as a result of improvements in the method of preparation.

Coffee. — The principal Experimental Station in connection with the cultivation of coffee is situated at Luda, about 5 miles from Stanleyville along the Great African Lakes Railway.

Attention is chiefly given to selection of suitable varieties, to the yield and to the different methods of preparation of the product,.

The Lula Station includes 200 acres of coffee plantations composed of several varieties, one half of which is now is full bearing.

The production of marketable coffee exceeds 8 cwt. per acre. In 1915 the production was 43 tons and in 1916 some 55 tons. Experts pronounce this coffee to be excellent.

Rubber. — Forest rubber, *i. e.* collected from the lianes and wild trees of the forests, was for a long time the only kind exported from the Belgian Congo. Until quite recently the production of plantation rubber was ll

significant and it was only when the State experimental plantations first matured *i. e.* in 1914, that this product appeared on the European market.

The cultivation of *Hevea brasiliensis*, begun at Bakusu (Equator) in 1904, has given encouraging results. It was only in 1910, however, after the reorganisation of the Department of Agriculture, that this crop was extended. Besides Bakusu there are now 10 other stations devoting their chief attention to rubber.

Experiments have shown that Hevea thrives well in the Congo, provided attention has been paid to securing the proper soil and climatic conditions.

Bakusu rubber has reached very satisfactory prices on the European markets and experts consider it to be of very good quality.

The cultivation of *Funtumia elastica* or " Ireh " a native tree, was undertaken as early as 1901, but active attention was only first paid to ts propagation in 1906.

The yield of this rubber tree is to low to justify pure plantations of *Funtumia*, but it seems capable of being turned to an interesting purpose : in 1912, in order to increase the yield per acre, the Department planted coffee and cacao among certain plantations of *Funtumia*. The result given by the planting of cacao seems particularly interesting, as the shade provided by the rubber-producing species appears to combine all the qualities required for encouraging the successful growth of the cacaos.

Manihot Glaziovii, or Ceara rubber tree, has been tried for a number of years in various parts of the Colony. The State possesses a very fine plantation, possibly one of the best in the whole of Africa, at the Station of Bokala (Middle-Congo).

Fibre plants. — Various kinds of *Agave* and *Fourcroya* are cultivated on the majority of agricultural stations in the colony. The largest plantations are at Congo da Lemba (Lower Congo).

Three varieties of Sisal have been tested so far : *Agave rigida*, var. *sisalana*, *Agave santula* and *Agave tequilana* (Weber or Azul).

Important experiments are now in progress with Sisal on the Lower Congo where climate and soil appear very favourable.

The *cotton plant* does admirably in the Belgian Congo. Those introduced at various unknown times by the Arabs and Portuguese are found throughout the Colony but are nowhere the object of regular cultivation. Some effort had been made previous to 1908 by the natives of the Lower Congo, but the results were nil. In 1911, it was resolved to have recourse to more scientific methods and the Government, through the agency of the " British Cotton-Growing Association ", engaged an American scientist, Mr. FISHER, who for several years had been in charge of the cotton plantations on the Gold Coast. This specialist was given the task of conducting trials in cotton growing throughout the various districts of the colony in turn in which the climate, soil and population appeared to be most suitable. He made a start in the Lower Congo and later introduced the plant in the district of Mamenia to the south of Stanleyville.

The results obtained were very satisfactory : the cotton was quoted

at a very high price at Liverpool, and the yield per acre was at least as high as in the remainder of the African Colonies.

The cotton-growing Station of Nyangwe continues its work, and Mr. FISHER has now been sent to the thickly-populated region of Kasai in order to introduce cotton growing in that part also.

B. STOCK-BREEDING. — *Zambi Zootechnical Station.* — This Station is chiefly concerned with acclimatisation trials with European and Asiatic breeds, and with crossing them with the indigenous breeds.

Mule breeding is conducted with the help of Belgian or Senegalese mares and asses from Poitou, Sicily and other parts of Italy.

Situated on the river bank in the midst of a wide grassy plain, close to Boma, the capital of the Congo, the Zambi establishment is splendidly adapted to the object in view.

The Laboratory of Veterinary Bacteriology is attached to this Station and so finds on the spot many of the elements necessary for its research.

Station of Katentania (Katanga). — Situated on the Bianos high plateaux, a region of immese pastures, this Station forms at present the largest centre for cattle breeding in the Colony. The herds, which, with the exception of a few half-bred bulls (Hereford and Devon), are composed entirely of animals of the Barotse and Mashakalumbe races, number nearly 2000 head, and pasture over some 124 000 acres of prairie and wooded savannah. A flock of Persian sheep has just been introduced (1916).

The task of this Station is to demonstrate the possibility of raising cattle and sheep on the Katanga high plateaux, to improve the natural pastures and, by means of selection, to raise animals adapted to the local conditions.

Nyangwe Stock Farm. — The Nyangwe Stock Farm, along the Lualaba river, is concerned with the development of stock-farming in the interesting region of Maniema. The natural conditions are favourable and the population, containing a large Arab element, is very intelligent.

The farm carries a herd of 500 cattle (including 70 draught oxen) and 50 horses.

Kivie breeding centre. — The district of Kivie, situated on the eastern frontier of the Belgian Congo, is one of the finest stock raising regions in the Colony. It carries numerous herds of native cattle, containing sometimes as many as 500 head.

The Department of Agriculture has sent several of its officiers to this part in order to study and promote breeding in a region which undoubtedly has a future.

Centre for the taming and training of elephants at Api (Uele). — In 1899 the Congo Free State undertook methodical work in capturing and training elephants. At the head of this work was Commandant LAPLUME who made the Camp of Api his head quarters.

At the present time the Colony possesses 35 elephants, young and mature animals, which are the object of progressive and methodical trai-

ning. Splendid results have been obtained with these beasts. It has been definitely proved that the African elephant is no whit behind its Asiatic relative in the matter of capacity for training.

Development of European Colonisation.

The Belgian Congo is essentially what one may term a colony for "colonisation", that is to say its riches can only be fully utilised by white colonists: individuals or financial concerns, agriculturists, traders or manufacturers.

The Equatorial Congo, owing to the moist and hot climate, is obviously less adapted to colonisation by Europeans than the higher regions with more temperate climate, situated to the East and West; nevertheless it is none the less capable of colonisation.

An attempt at colonisation has been begun in the Central Congo, at Kunzulu (Middle Congo), with the object of establishing, in the tropical zones of Africa, a European population. Although the results cannot yet be said to be complete, they have nevertheless shown that whites are perfectly capable of living nd working in these regions. The attempts will be continued for number of years to come.

Katanga, owing to its healthy climate and numerous population employed in the copper mines, has long since attracted the attention of the Government which proposed to establish a European farming colony in that region.

The attempt at colonisation made in 1911 in the neighbourhood of Elizabethville with the idea of establishing a number of small proprietors, has passed through some very difficult times, but it must be admitted that the farmers installed at Katanga have made real progress of recent years. They have become true colonials with a great attachment to their farms.

Around Elizabethville and Kambove there are some forty properties and the value of the harvests obtained by these small farms has already reached a respectable figure.

Larger farms, of 740 to 2500 acres and more, are in course of preparation.

While the small holdings are specially concerned with market gardening, the larger farms are devoted to raising maize.

The district of Ituri, and particularly the neighbouring region of Lolo, also deserve attention both on account of the quality of the soil and of the excellent climate. It is particularly adapted to European colonisation and a number of white farmers have obtained very encouraging results.

Development of Native Agriculture.

In 1914 a resolve was made to set on foot a special organisation in order to develop native agriculture along systematic lines and to introduce into the villages crops capable of being exported.

The programme will be based on the cooperation of the territorial and agricultural departments. With this view the latter will appoint one or more agricultural scientists for each district where it is intended to start the propaganda.

The territorial authority, represented by the Commissioner of the District who is responsible for native affairs, will set to work on the population by persuasion and by explaining to them the advantages they will derive from the adoption of new crops or from the development of the old.

Next, the district agricultural officer will deal with the technical side of the question, will visit the villages, instruct the natives as to the new crops best suited to their district, inspect plantations and harvests, explain the precautions to be taken in order to obtain an abundant and high quality product and will show the profit resulting from its sale.

The district agricultural officier is undoubtedly the person indicated and indeed used for the purpose of controlling the sale of the products. In case of necessity, where dealers refrain from buying or tender inferior prices, he will procure the whole of the harvest for the State.

The propaganda will be carried out on a definite and precise plan and after an exhaustive study of the natural and economic conditions of the region.

In order to obtain large and regular exports such as it is wished to establish in the Congo, account must be taken of the methods of transport, of the aptitudes of the various native tribes and of the amount of care they are capable of exercising in the preparation of the products, in order to obtain satisfactory quotations on the European markets.

The results of the preliminary efforts of this organisation may already be seen: the growing of cotton by natives has developed in a number of districts; elsewhere it is that of rice, *Elaeis*, ground-nut etc.

In some districts an impetus has been given to stock-raising and breeding animals have been distributed aong the most intelligent chiefs.

Publications of the Department of Agriculture.

1) Since 1910 the central administration has published an illustrated quarterly journal, the *Bulletin agricole du Congo belge*.

Other publications of the Department are:

2) *Mémoires scientifiques*, the 1st number of which is entitled *L'appareil laticifère des caoutchoutiers* and is by Prof. A. Meunier D. Sc.

3) *Studies in Agricultural Biology*, 2 numbers of which have already appeared, viz:

Notes on *Glossinae* or tsetse flies, by E. Hegh, agricultural scientist on the staff of the Colonial Office;

The Ticks of the Belgian Congo and the Diseases transmitted thereby by Prof. Nuttall of Cambridge University.

Other works are in preparation, viz:

Study of African Termites, by E. Hegh, cited above.

The Coccidae, by Prof. NEWSTEAD of the Liverpool School of Tropical Medicine.

4) Various *Practical Notes* for agricultural colonists.

AGRICULTURAL ESTIMATES.

The Estimates of the Department of Agriculture for the year 1917 contain the following items:

1) Salaries of Colonial European Staff . . .	854 700 fr.
2) Salaries and upkeep of Native Staff . . .	381 770
3) Equipment of Agricultural Stations: purchase of cattle, material, etc.	152 670
Total	1 389 140 fr.

SECOND PART.

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

117 - **Agricultural Development of the Province of Ontario, Canada.** — BERT ROWLAND HOUSE W. — Deputy Minister of Agriculture, in *The Agricultural Gazette of Canada*. Vol. III, No. 9, pp. 799-806. Ottawa, September, 1916.

A very large amount of the Province of Ontario, probably over 30 million acres, is covered by great lakes and some of the larger timber reserves.

The section of the Province which is usually referred to as Ontario, and which includes a great part of the population, represents about 25 million assessed acres of which about 15 million acres are cleared. There is in addition the vast region known as New Ontario, which includes the clay belt, which alone is estimated to contain 20 million acres. This is now being opened up and there is no doubt but what there are agricultural possibilities as yet untouched far greater than what have so far been developed. The evolution of the Province through different stages of development, from the first settlements along the lakes and rivers, to the gradual pushing farther back of forests, is represented today by nearly 200 000 splendid farms, reached by 55 000 miles of rural highways, served by 3000 miles of steam railways and about 500 miles of electric railways and equipped with approximately 85 000 rural telephones. To this scene of rural Ontario, with the farmers of to-day speeding in their automobiles over the 55 000 miles of highways, must be added the scores of prosperous and progressive towns, and cities which are dotted every few miles and play their part in serving the rural communities. The rural population in the last census was 1 295 323 against 818 999 urban. The evolution in farming has been characterized in the last 25 years by an increase in the acreage of oats, maize, and hay and a decrease in the acreage of spring wheat, barley and winter wheat.

The following figures as to acreages in 1890 and 1914 may be of nterest :

		W. Wheat	S. Wheat	Barley	Oats	Corn	Hay and Clover
Acres	1890. . .	720 101	601 753	701 326	1 882 366	223 836	2 462 002
	1914. . .	685 692	118 607	579 473	2 776 883	708 922	3 415 484

The increase in live stock in the same period was :

	1890	1915
Horses	659 636	779 131
Milch Cows	777 838	1 022 518
Other Cattle	1 116 874	1 652 228
Swine	1 140 559	1 764 295
Sheep	1 339 695	908 095
Poultry	6 854 864	14 273 091

Practically all parts of what is known as Old Ontario are now engaged mixed farming with most farms having some line on which they specia- e. Dairying is adopted very generally in Eastern Ontario where there e nearly nine hundred cheese factories, and in Western Ontario, where ere are a large number of creameries and a few cheese factories. In the ore northerly counties, districts are devoted more generally to beef ttle, but herds of beef cattle and swine may be found in every county. here is now in the province a fruit industry which represents possibly enty million dollars annually, and a vegetable industry which aggregates veral million dollars. Fruit growing has flourished in Ontario and 75 % ll the fruit in the Dominion is grown in this province. This includes % of the peaches and 60 % of the plums, 70 % of the apples and 80 % ears and small fruits. The peach-growing areas are located for the most t in the Niagara district skirting lake Ontario as far west as Niagara, new and promising districts are now being developed in Norfolk, Essex l Lambton counties. The Niagara district is also the large vineyard the province but plums and apples are grown in most sections. The cial apple sections, however, are in Western Ontario, especially ng Lake Erie and Lake Huron and north as far as Georgian Bay and in tern Ontario along Lake Ontario and the St. Lawrence, including the latter Dundas county which is the native home of the famous ntosh Red apple. Altogether 306 767 acres are devoted to orchards. 60 to small fruits and 11 136 to vineyards. The products are marketed he provinces in the West and to some extent in the export markets reat Britain.

Ontario's annual returns from her fields aggregate in a good year over million dollars. To this should be added possibly over another one dred million from her live stock products. The following figures show contrast in 25 years development in connection with the farm lands, dings, implements and live stock in this province.

		Farm Land	Buildings	Implements	Live Stock	Total Farm Property
ue	1890. . .	622 886 000	193 438 826	50 515 583	101 086 626	970 927 035
llars	1914. . .	790 538 706	347 348 643	91 703 876	250 870 078	1 480 461 303

In connection with this development the work of the Ontario Department of Agriculture has had an important phase as a guiding factor.

Ontario, because of the diversity of the agriculture of the province, as above outlined, has many problems to face which are not in evidence in other provinces, but there is every reason to believe that these problems will be solved to the advantage of the people as a whole.

118 - **Recent Researches of the Imperial Institute on: Fibres from the Belgian Congo; the Pineapple as Fruit and Fibre Producer; Ceara Rubber from *Manihot Glaziovii* in Nigeria; the Essential Oil from the Tubers of *Kaempferia Ethelae*; The Essential Oil of *Cymbopogon flexuosus*.** — *Bulletin of the Imperial Institute*, Vol. XIV, No. 3, pp. 378-388; 437-460. London, July-September, 1916.

FIBRES FROM THE BELGIAN CONGO. — The Imperial Institute of London has given all facilities to the Belgian authorities for dealing with the products of the Belgian Congo, and they have accordingly examined the bark of the baobab tree (*Adansonia digitata*); punga bark (*Cephalonema polyandrum*, a bush, 12 ft. high, found in the Belgian Congo and the Cameroons); several *Agave* and *Furcræa* fibres; and cord and rope made from the various fibres.

Both the baobab and punga barks could be suitable for paper-making. The former is in favour in the United Kingdom for the production of wrapping papers with a high finish, and properly prepared material, i.e. with the outer bark removed, would fetch about £ 8 per ton in the United Kingdom under normal conditions.

The results of the examination of the fibres is given in Table I.

TABLE I. — *Analysis and estimation of Agave and Furcraea fibres from the Belgian Congo.*

	Percentage composition						Length	Value per ton
	Moisture	Ash	2% Hydrolysis, loss	3% Hydrolysis, loss	Acid purification, loss	Cellulose		
A. *rigida* var. *sisalana* . .	8.6%	1.2%	12.9%	14.6%	3.1%	77.3%	4 ft	£ 30
A. *Cantala* . .	8.8	1.4	15.4	15.5	3.5	75.0	3-4 ft	£ 28
A. *Azul*. . . .	9.2	1.4	14.0	17.3	3.1	74.7	4-5 ft	£ 45-50
F. *Gigantea* . .	0.4	1.8	17.1	18.5	5.4	74.2	5 ft	£ 45-50
F. *Lindeni* . .	9.3	1.4	13.5	15.1	2.5	77.1	4 1/2 ft	£ 18

(1) Valued at London with «fair» Manila hemp at £ 53 per ton (April 1916).

THE PINEAPPLE AS A FRUIT AND FIBRE PRODUCER. — This paper considers the botanical characters of the plant and its principal varieties, climatic conditions and soil requirements — the preparation of the soil

propagation and planting, after-cultivation, manuring, harvesting yield (8000 to 15 000 fruits per acre in the West Indies, in Porto Rico from 10 to 14 tons per acre, in the Straits Settlements the yield is only about 5 000 fruits per acre; in Queensland up to 12 000 fruits per acre or over 13 tons of fruit per acre) — grading and packing — insect pests and fungoid diseases — inning or canning pine-apples — pineapple fibre — pineapple cultivation in the British Empire.

The principal supplies of fresh fruit that reach the markets of the United Kingdom are derived from the Azores (in 1914 the latter exported 7500 cases worth £ 66 444). The tinned pineapple is imported chiefly from Singapore; in 1915, 305 709 cwts worth £ 401 732 were imported into Great Britain. In the British Empire, the pineapple is cultivated: in many parts of India (Malabar coast), Burma, Khasi hills (Assam), Ceylon, Mauritius (in these two islands, the pineapple does well, but is only grown on a small scale) — Straits Settlements, where it forms an important industry, in which the cultivation and tinning are mainly carried out by Chinese, while the Europeans export the finished product (*in 1914 Singapore exported 654 36 cases of pineapples worth £ 305 383 of which 514 530 cases were sent to the United Kingdom*) — Hong Kong New Territory — in Queensland (in 1914, the crop occupied 2584 acres producing 679 646 dozen fruits valued at £ 67 965) — in New South Wales — in the Northern Territory of Australia — in South Africa (Cape Province, Natal, Transvaal) — in British East Africa — Gold Coast — in the Southern Provinces of Nigeria — in the British West Indies, where this crop has declined owing to competition by Porto Rico and Cuba. Outside the British Empire the largest producer of tinned pineapples is Hawaii, where in 1913 the export was 900 000 cases, that is, about equal to the annual export of fresh fruit from Florida, Cuba, and Porto Rico together. The cultivation can be greatly increased or introduced in many countries; it is especially suitable as an intercrop with citrus fruits. In Porto Rico this combination is said to give satisfactory results.

Pineapple fibre is produced in fairly large quantities on the island of Hainan, South China, and on the Liu-Chow Peninsula on the mainland opposite. It is also produced on a smaller scale in Formosa, Hawaii and the Philippine Islands. In the latter, the fibre is made into fine fabrics known as piña cloth. For fibre production the plants are grown closer together than when fruit only is required in order to induce the formation of long leaves; or they may be grown under trees in partial shade.

The preparation of the fibre involves very tedious manual labour, as a machine product is not of such good quality, which is a serious obstacle to the spread of the industry. In Hainan the leaves may be gathered the first year, but it is more usual to wait till the second year, as better quality is obtained. About 12 leaves are taken from each plant, each leaf then being scraped on both sides to remove the green tissues. The fibres are then alternately macerated in cold water for 6 hours, then dried in the sun, for several times lasting about 3 days. In the Philippines, each layer of fibres is removed as it is exposed by the scraping; 50 to 60 lb. of

fibre is obtained per ton of green leaves, which is very low considering the amount of labour involved. The combings from pineapple fibre are said to give excellent results for paper making.

CEARA RUBBER FROM *Manihot Glaziovii* IN NIGERIA. — 2 samples of rubber were examined from the Government plantation at Ankpa, Bassa (Northern Provinces) and obtained respectively in 1915 from 3 year old trees, and in 1916, from 4 year old trees. The physical properties were determined on the second sample, the results being given in Tables II and III.

TABLE II. — *Analysis and valuation of samples of rubber from Manihot Glaziovii in Nigeria.*

Samples	Loss on washing (moisture and impurities)	Percentage Composition of Dried and Washed Rubber				Value per lb. at London
		Rubber	Resin	Protein	Ash	
1915.	5.3%	83.1%	5.3%	9.9%	1.7%	2s. – 2s. 1d. (1)
1916.	8.0	84.7	6.3	7.7	1.3	2s. 4d. – 2s. 6d. (2)

(1) With fine hard Para at 2s. 6 3/4d. per lb.
(2) April 1916.

TABLE III. — *Physical properties of the vulcanised rubber.*

	Time of Cure minutes at 50 lb. pressure	Tensile strength lbs. per sq. in.	Elongation Per cent.
Present Sample	50	2 330	847
Plantation Para Sheet (average figures)	70	2 300–2 400	875

THE ESSENTIAL OIL FROM SHERUNGULU TUBERS (*Kaempferia Ethelæ*). — The Table IV summarises the results of the recent examination of sample and also of another sample examined previously (*Bulletin of the Imperial Institute*, Vol. XIII, 15, 1915). It will not be profitable to distil the tubers for the production of oil as the oil does not possess a desirable odour or a sufficient amount of any constituent which is particularly useful from a perfumery point of view. Both essence extraction and distillation processes failed to yield a valuable oil. The reason is that, although the oil contains methyl anthranilate, both valuable perfumes, these are only present in small amount, and their odour is masked by the unpleasant smell of other constituents like cineol and the solid ketone. Further, the high boiling constituents of the oil are of a comparatively odourless type and consequently the oil, considered as a perfume, lacks persistence.

TABLE IV. — *Results of examining the essential oil obtained by distilling.*

	Sample examined in 1916	Sample examined in 1915
Yield of volatile oil, expressed on the tubers as received	2.35	1.9
Specific gravity at 15° C	0.924	0.944
Optical rotation in a 100 mm. tube at 22° C.	64.2	19.477
Acid Value	1.0	2.3
Ester value before acetylation	11.5	5
Ester value after acetylation	32.6	47.6
Fractional Distillation		
Fraction distilling at 160°-195° C	44	42
Fraction distilling at 195°-270° C	26	25
Residue (Chiefly ketone and sesquiterpene)	30	33

THE ESSENTIAL OIL OF LEMON GRASS (*Cymbopogon flexuosus*) FROM INDIA. — The plant was identified at Kew as *C. flexuosus* Stapf. *f. albescens*. The oil obtained from this plant had the usual odour, was cloudy and of reddish-brown colour. The oil was too dark to find its optical rotation.

TABLE V. — *Shows its main characteristics.*

Specific gravity at 15° C		0.915
Aldehydes, per cent		81.0
Solubility:		
in 80 % alcohol	Soluble in 0.7 or more vols. becoming slightly turbid in 1.5 vols.	
in 70 % alcohol	Not soluble in 5 vols. at 15° C., but soluble in 2.5 vols at 20° C	

From the fact that this sample of oil, prepared from authentic materials of an " insoluble " type, it seems clear that the occasional " insolubility " of Cochin lemon grass oil is not due to chance inclusion with the ordinary lemon grass (*C. flexuosus*) of other wild grasses yielding an " insoluble " oil; the " insolubility " is probably due to the distillation being carried too far, so that " insoluble " constituents " are included in the distillate.

CROPS AND CULTIVATION.

Experiments on Loss of Moisture from Soils by Evaporation (Dry Farming). — DE ANGELIS D'OSSAT G., in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. XLIX, No. 11, pp. 563-582, 4 tables, 7 fig. Modena, 1916 (Abstract by Author).

There occur not only in the Italian colonies, but also in Italy itself especially in Sicily and Sardinia and in the southern portion of the peninsula years of low rainfall comparable with and even drier than those ordinarly experienced in the semi-arid zones. In such cases therefore it is essential that the rules applying to " dry-farming " should be followed.

In this connection the writer has carried out laboratory researches during the last 3 years on evaporation of moisture from sands, clays and loams. The liquid employed was distilled water and, in order to allow for varia-

tions due to the density of the liquid in circulation, use was also made of distilled water saturated with gypsum.

The soils have been throughly investigated as to their lithological, physical and mechanical characters and properties. The *colloidal clay* has also been separated and weighed, according to KONIG'S method. The author gives a table showing in detail all the variations in the weights of soils, observed during June and July 1916, in relation to maximum and minimum temperatures and absolute and relative humidity.

Weights (in grams) and volumes (%) of water evaporated during the ascending phase (from 4th to 19th June, 1916).

Nos. of pots	Soil	Weight of water evaporated in grams	Differences	Volume of water evaporated	Differences
	Distilled water:				
1	Sand	109.0 gr.	53.6 gr.	72.66 %	35.73 %
2	Sand	55.4 gr.		36.93 %	
3	Sand 2/3 + Clay 1/3	105.0 gr.	35.8 gr.	70.00 %	23.87 %
4	Sand 2/3 + Clay 1/3	69.2 gr.		46.13 %	
5	Sand 1/3 + Clay 2/3	98.4 gr.	31.2 gr.	65.60 %	20.80 %
6	Sand 1/3 + Clay 2/3	67.2 gr.		44.80 %	
7	Clay	70.2 gr.	17.2 gr.	46.80 %	11.47 %
8	Clay	53.0 gr.		35.33 %	
	Distilled water saturated with Gypsum:				
9	Sand	106.8 gr.	38.3 gr.	71.20 %	25.53
10	Sand	68.5 gr.		45.66 %	
11	Clay	87.2 gr.	27.4 gr.	58.13 %	18.27
12	Clay	59.8 gr.		39.86 %	

In the above table, which gives the evaporation data obtained from 4th to the 19th of June, the odd numbers indicate the pots in which soil surface remained packed during the period covered by the observatio while the even numbers refer to the soils the surfaces of which had b loosened.

The results as recorded in this table enable the following conclusions be drawn:

1) During the period from the 4th to the 19th June, the *definitely andy* soils with loosened surface retained 35.73 % more water (in volume) han the soils of similar nature with packed surface.

2) In the same conditions, the *clay* soils with loosened surface re-ained 11.47 % more water than those with packed surface.

3) In soils composed of: sand $^2/_3$, clay $^1/_3$, the increase in the pro-ortion of humidity retained due to the loosening of the surface was 3.87 %.

4) In soils composed of: sand $^1/_3$, clay $^2/_3$, this increase was 20.80 %.

5) In soils, in which the water was saturated with gypsum, advan-ages were observed analogous to those obtained by loosening the surface ayer, but the differences between sand and clay were less noticeable.

The percentage volumes of water remaining in the sand and in the lay after the period of evaporation were:

Sand		Clay	
with packed surface layer	with loose surface layer	with packed surface layer	with loose surface layer
27.34 %	63.07 %	58.20 %	64.67 %

In relating the differences found in pots Nos 1 and 2 to natural nditions and supposing the moisture capacity of the soil to be at its ximum (40 %) at the beginning of the experiment, it is seen that:

The difference in evaporation exceeds in amount a layer of water 14 cm. 5, that is to say that the soil with loose surface layer retains per hectare hect = 2.4711 acres) at least 1 400 cubic meters more water than the soil th compact surface layer.

The writer recommends further experiments of this type under na-ral conditions as varied as possible with regard to character of soil, sition, altitude, type of crop, etc., especially in Central and Southern ly

Stimulating Influence of Arsenic upon the Nitrogen-Fixing Organisms of the Soil.

GREAVES, J. E., (Bacteriologist, Utah Agricultural Experiment Station) in *Journal of Agricultural Research*, Vol. VI., No. 11, pp. 389-420 + fig. 1-5. Washington D. C. June 12, 1916.

In the course of previous experiments, the writer found that the addi-n of arsenic to the soil stimulates the ammonifying, and especially nitrifying microorganisms. The stimulation varied greatly with the e, quantity, and method of applying the arsenic. Further, it was found t very large quantities of arsenic had to be applied to a soil before its ic effect became marked. This toxic effect became pronounced only en quantities of arsenic which far exceeded those found in any of the cul-ated soils had been applied. Therefore it was desirable to determine influence and mode of action of arsenic upon the nitrogen-fixing powers the soil. For this purpose the writer made cultures in a sandy loam to ich mannite was added as well as the various arsenical compounds, in ution and in the dry state, which were used in the experiment. After

incubation, the total nitrogen was determined. The arsenical compounds used were: sodium arsenate, lead arsenate, cupric aceto-arsenite (Paris Green), arsenic trisulphide and zinc arsenite in the serial proportions of 0 to 400 p. p. m.

The data thus obtained, and the results given by similar experiments carried out by other writers, prove conclusively that arsenic, when added to the soil in the forms of sodium arsenate, lead arsenate, or of arsenic trisulphide and zinc arsenite, stimulates the nitrogen-fixing powers of the soil. This stimulation is greatest when lead arsenate is applied and least when zinc arsenite is used. Paris green did not stimulate in any of the concentrations and became very toxic when the concentration reached 120 p. p. m. The toxicity of this compound is due to the copper, and not to the arsenic contained in it. Sodium arsenate became toxic when a concentration of 40 p. p. m. of arsenic was added, and 250 p. p. m. of arsenic entirely stopped nitrogen fixation. On the other hand, lead arsenate was not toxic, even at a concentration of 400 p. p. m. of arsenic, while the toxicity of arsenic trisulphide and of zinc arsenite was very small at this concentration.

The stimulating effect of arsenic is not due to any inherent peculiarity of the soil used, for soils which vary greatly in physical and chemical properties had their nitrogen-fixing powers greatly increased when arsenic was applied to them. Soils high in organic matter fixed as much nitrogen, in the presence of arsenic and in the absence of mannite, than they did in the absence of arsenic and the presence of mannite. The stimulation is greatest when the water-soluble arsenic content is about 10 p. p. m. and as this quantity exceeds that found in most soils, it is probable that in agricultural practice, arsenic will stimulate and not retard bacterial activity in the soil.

Only one type of *Azotobacter* was isolated which was stimulated by arsenic, and in this case the stimulation was due to the organism utilising its source of carbon more economically in the presence of arsenic than in the absence of arsenic. Thus arsenic and its compounds do not act as sources of energy to the organisms. The main part of the stimulation noted in the soil with its mixed flora is undoubtedly due to the arsenic inhibiting injurious species.

A given quantity of arsenic which act as a stimulant to bacteria when placed in soil may become very toxic when tested by the Remy-*solution method (1)*.

Arsenic cannot replace phosphorus in the vital process of the nitrogen-fixing organisms, but it can in some manner liberate the phosphorus from its insoluble compounds. This may be either a direct, or an indirect, action.

The cellulose ferments are stimulated by arsenic, and in their turn react upon the activity of the nitrogen-fixing organisms.

The nitrogen-fixing powers of soil extract, of filtered soil extract and

(1) An inoculated and incubated nutritive solution containing, bi-potassic phosphate 2 per 1000 - magnesium sulphate 0.2 per 1000 - calcium chloride 0.2 per 1000 - calcium carbonate 10 per 1000 - ferric chloride 1 drop of solution containing 10 % per litre. [Ed.]

soil dried for some time are only slightly stimulated by arsenic, which shows that arsenic acts mainly by the removal of a thermolabile body occurring in the soil.

In the appendix is a bibliography of the 45 publications mentioned in the text of the article.

121 - **On the Classification of Soils according to the Electrical Conductivity of their Aqueous Extract.** — VON HOWATH B., in *Internationale Mitteilun en für Bodenkunde*, Vol. 6, Part 4, pp. 230-236. Berlin, 1916.

The writer has experimented with a view to finding if the electrical conductivity of a aqueous extract from soil could furnish a criterion for the classification of soils. The extract was made with carefully distilled water having an electrical conductivity $x + 10^6 = 3.35$ at 18° C by the GEDROIC method used by the Bureau of Soils of the United States. 50 grms of soil were put in a beaker and washed with 250 cc. of distilled water ; it was stirred with a glass rod for 3 minutes; then after filtering, the filtrate was tested to ascertain its electrical conductivity.

This determination was carried out by a telephonic measurement, using the alternating current method of KOHLRAUSCH, in a thermostat at 18°C, where the temperature did not vary more than 0.05°C. The resistance of the electrodes was determined on a saturated solution of gypsum. The conductivity of the aqueous extracts was very weak, and in order to show its value better, the author has multiplied the value of x by the factor 10^6. The conductivity was determined of the acqueous extract of the top layers of about 40 different soils. The Table quoted shows the results that were obtained.

			Conductivity
I	Forest soils... 18.1-144.38	1) Grey forest soil, 9 samples.	18.4 - 80.3
		2) Brown forest soil, 3 samples . . .	75.6 - 144.38
II	Steppe soils.. 3.16-1361..	1) Prairie clay, 3 samples	71.3 - 88.23
		2) Black steppe soil, 2 samples.	51.9 - 133.75
		3) Brown steppe soil, 8 samples.	60.2 - 203.0
		4) Salt soil, 5 samples	43.16- 1364.0
III	Non-zonal soils 14.7-1047.52	1) Alluvial soil, 3 samples	64.0 - 1047.52
		2) Sandy soil, 7 samples	14.7 - 240.49

The numbers obtained show such a great difference between the extremes of conductivity. Further the fact must be taken into account that if, in cultivating the soil, the layers of the soil are mixed, then the new upper layer formed has another conductivity. The electrical conductivity of the aqueous soil-extract only represents the relative content of soluble salts in the soils, and is therefore of no use for the classification of soils.

122 **New Phospatic Limestone Deposits in Mexico.** — FLORES TEODORO, in *Memorias y Revista de la Sociedad Cientifica Antonio Alzate*, Vol. 34, No. 10, pp. 351-362, 5 Plates, Mexico, October 1916.

On the southern slope of the Cerro de Topo Chico, about 4 miles to the north-west of Monterrey and some 2 200 feet about sea-level,

the writer has discovered a deposit of phosphate of lime. A survey has already been begun. The mineral is concretionary in form and of varying structure — oolitic — mammillated — compact — earthy — in concentric layers. The samples analysed at the Chemical Laboratory of the National Geological Institute of Mexico contained at least 75.98 % of tricalcic phosphate. Apparently it is a case of secondary phosphates formed by dissolution, transport and concentration of the phosphate contained in the volcanic ash or in the lapilli of the district (Cretaceous), either in the form of apatites or in the form of phosphated organic detritus ; or possibly it may also be a question of phosphates derived from the Jurassic rocks which should be present to a considerable depth in the region of Monterrey.

123 - **Experimental Kelp Plant at Summerland, California** (1). — *Engineering and Mining Journal*, Vol. CII, No. 25, p. 1070. New York, December 16, 1916.

The Bureau of Soils of the Department of Agriculture is preparing to erect at Summerland, Calif., an experimental plant for the production of potash from Pacific Coast kelp. The details of the plant are not completely developed yet, but Mr D. F. HOUSTOVN, Secretary of Agriculture, states that the plans contemplate the drying of the kelp as it comes from the water in a series of rotary driers, after which the dried material will be distilled in retorts analogous to a byproduct coke oven.

Ammonia, combustible gas, tar and some other materials will be recovered, and the resulting charcoal will contain the potash salts. These will be leached out and recovered by evaporation, after which the charcoal will be available either as a marketable commodity or as fuel. By recovering the various byproducts and saving the heat units involved in the combustion of the kelp, the Bureau of Soils hopes to develop a process that will permit the continued production of potash from this American source (2).

124 - **Soil Fertilisation by means of Bacteria : Results of Experiments made in 1915 with the Preparation from the Bacteriological Laboratory of the Russian Department of Agriculture.** — Макринов И. А. (MAKRINOV I. A.), in *Результаты применения бактеріальныхъ зем.удобрительныхъ препаратовъ въ опытахъ 1915 года* (*Results of Experiments with Fertilising Preparations of Bacteria in 1915*), IV + 83 pp. Petrograd 1916.

In a previous work (3) ; the writer had shown that the frequent want of success attending the use of bacterial fertilising preparations was not due to the method of inoculating the soil with the bacteria for increasing its nitrogen content, but must be attributed to : 1) the inferior quality of the preparations employed ; 2) the irrational use of the said preparations.

(1) The Manurial Research Department of the Soils Bureau has been separated to form the « Bureau of Fertilisers » as an independent Division of the Agricultural Department of the United States. — See : *The American Fertilisers*, XLV, 4oa, Dec. 9, 1916. (*Ed.*

(2) See *B.* 1916, No. 1261 ; *B.* Jan. 1917, No. 91. (*Ed.*

(3) Макринов И. А. (MAKRINOV J. A.) *Бактеріальные зем.удобрительные препараты и ихъ практическое примѣненіе.* (Bacterial Fertilising Preparations and their Use), III + 100 pp. Petrograd 1915.

The writer, with the support of the Department of Agriculture, organized a series of experiments in different parts of the Russian Empire. It had been intended to carry out 300 experiments, but owing to the difficult times, the number was reduced to 68. Several officials of the said Department and of the "zemstwos", as well as some private agriculturists, took part in these experiments. The area of the experimental plots varied from 4.55 to 4100 square metres.

The bacterial preparation was made by the writer himself, it was a pure culture of *Bacillus radicicola* in a liquid medium and contained the strains adapted to clover, vetch and lupin; a pure culture of *Azotobacter chroococcum* being also added. In order to obtain a predominance of *B. radicicola*, which is the chief agent, as it exercises a direct action upon the plant, the sterile medium was first inoculated with this bacterium and then with the culture of *Azotobacter*, either after 1 day, or only after the *B. radicicola* had begun development.

The preparation contained about 200 cc. of nutritive culture, an amount sufficient to infect enough small seeds (clover and lucerne) to sow 1 hectare (= 2.47 acres); in the case of larger seeds such as vetch, however, it is necessary to add cold or boiled milk, or plain water, in order to increase the quantity.

The preparation was considered to be of good quality when it contained *Bacteria radicicola* which were not only capable of growing in the usual cultural media but also possessed, in some measure, the property of assimilating free nitrogen and the power of developing on the roots of the plant.

An enquiry as to the results of each experiment was made on a printed form and the following facts ascertained:

1) The result was negative in 8.8 per cent of the total number of experiments (68). This was a lower proportion than that obtained in similar experiments carried out in Western Europe and in America.

2) In all the other experiments, the increase in yield varied within very wide limits; 5.7 to 108.7 per cent; but the extremes were observed in only a few cases. The increase varied from 5.6 to 10 per cent in 2 experiments and from 100 to 108.7 per cent in 2 others; in a large number of experiments (30) the increase in the crop varied from 20 to 40 per cent.

On arranging the results of the enquiry in different groups according to the fertilisers applied, the increase in the yields is found to be as follows:

Fertiliser	Increase in Yield
None	36.1 %
Lime	32.0
Basic Slag	20.3
Basic Slag + potassic salts	47.0
Superphosphate	32.8
Superphosphate + potassic salts	12.5

3) The other good result of the inoculation of the soil, namely the increase in the number of nodules on the roots of the infected plants, as compared with the uninfected ones, was more stable and more noticeable

than the increase in the yield. In fact in almost every case, an increase in the number of nodules was observed, and as a rule the effect of inoculation was all the more striking owing to the great difference in the number of the nodules present on the infected and uninfected plants respectively.

4) In many cases, a better development of the root system was observed and it may be said that the increase in the number of nodules was accompanied by an increase in the root mass.

5) Many workers have observed more rapid growth and earlier maturity in the case of the plants in the inoculated plot. On one occasion, they were ripe 6 days sooner than the plants of the control plot.

On the basis of the results obtained the writer has drawn the following conclusions

1) The chief factor upon which success in soil inoculation depends, is the quality of the bacterial preparation, that is to say, the activity of *B. radicicola*. Indeed, in 2 cases where the action of the bacteria was weak (as was shown by an examination of the preparation carried out in the laboratory) the results of the experiment were negative, in spite of all the other conditions being favourable.

2) Mineral fertilisers greatly contribute to increase the effect of soil inoculation. The following are specially useful: *a*) Lime; *b*) Basic slag; *c*) superphosphate + lime; *d*) Basic slag + lime; they should therefore be used as much as possible. The writer insists upon the necessity of applying basic slag + lime, even if only in small quantities. To this mixture he attributes a stimulating action both on the plant and the root bacteria. To support his statement he quotes an experiment he carried out in pots each containing 5 kg. of sand which had been freed from all salts by treatment with acids, and of all organic matter by burning. On adding to each pot a given quantity of nutrient salts, and also, in some cases, a small amount of basic slag (0.75 gr) and lime (0.2 gr.) per pot it was observed that the growth of the inoculated plants increased.

3) Superphosphate should not be used as a fertiliser, either alone or with the addition of potassic salts.

4) The results obtained show, that by organising the experiments systematically, and by improving both the bacterial preparation and the technique of its use, it is possible to decrease the number of experiments with negative results and increase the effect of soil inoculation.

125 - **On the Study of the Root System of Cereals.** Воробьевъ С. Д. [VOROBIEV S. D.]: *Сельское Хозяйство и Лѣсоводство* [Agriculture and Sylviculture], Vol. CCL. 66th Year, pp. 177-[illegible]. Petrograd, August 1916.

The writer discusses previous researches on the root system of cultivated plants. He considers that, with regard to the analysis of the life of the root from the purely external point of view these researches have thrown light upon two points only:

1) the depth to which the roots of various cultivated plants penetrate into the soil; 2) the relative position which the mass of the roots assume in the various soil layers where they occur. If, further, we take into account the fact that ROTMISTROV, by means of special trenches has

been able to record the growth of the roots day by day, the picture of the linear development of the root in the soil is sufficiently complete and clear.

All preceding work is in agreement with regard to one general fact: in proportion as the plant develops, the roots of cereals diminish gradually in mass as they penetrate into the lower layers, both relatively and absolutely.

Taking as basis this distribution of the root mass in the soil, it is generally admitted that the consumption of water is greater in the layer where this mass is most considerable. The writer shared this opinion himself until he had studied the consumption of water by plants under field conditions, when he observed phenomena which were contradictory to this general opinion. For instance, on a piece of land under winter rye, 3 moisture determinations were made in layers of varying depth and at varying stages in the growth of the plant. The resulting data are shown in the appended table.

Water consumption by winter rye at varying stages of growth, in layers of varying depth.

Depth of soil layer	Moisture		
	end of April	coming into ear	maturity
5 cm	26.23 %	17.35	11.00 %
10	32.40	19.01	14.05
25	35.65	16.98	15.09
50	30.39	25.86	16.89
75	27.16	27.19	17.21
100	22.59	20.69	22.30

In this table the writer draws attention to the fact that at the time of coming into ear the rye absorbs moisture with greater intensity at a depth of 25 cm. where, at the end of April the percentage of water was 35.65, whilst at the time of earing it was 16.98 %; that is to say that during the whole of this period the plant absorbed from this layer 18.67 % (35.65 % - 16.98 %), whereas at a depth of 50 cm. the consumption was only 1.53 % (30.39 % – 25.80 %) and, in the deepest layers the reserve of water had not been touched. If comparison is made of the water percentages at earing and at maturity, it is seen that at this latter period, at a depth of 25 cm. the plant absorbs only 1.89 % (16.98 % – 15.09 %) and that the maximum absorption of water during harvest occurs at a depth of 75 cm. where the diminution of moisture, between earing and maturation, reaches 9.98 % (27.19 % – 17.21 %), whereas in the preceding determination, at the period of earing, the reserves of water at this depth are still intact.

The writer puts forward the following statement based on the foregoing cases and on others observed in the dry regions of South west Russia: absorption of water by the plant at the various stages of its growth is in direct relationship neither with the total area of the root system nor yet with its weight, but is chiefly determined by the size of the *functional* portion of the root.

On this basis the study of the morphology of the root (determination of length and volume) can throw no light on the question of the sum or of the intensity of the physiological work of the root with regard to absorption of soil moisture. Only the dynamical determination of the functional part of the root can aid in elucidating such problems.

Regarding the root hairs as the chief agents in the absorption of water, and attributing to their development the varying consumption of water during the various growth phases of the plant, the writer has conducted experiments on their formation and development. The trial made in 1914 at the Volsk Esperimental Field, in order to study the daily growth of the plant by means of a trench 2 metres deep and by replacing one of the walls of this latter by a glass plate 1.5 m. × m., was unsuccessful as this system only allows the observation of a portion of the root, viz that nearest the glass.

The author then had recourse to a modification of the moist air method used by ARZIKHOVSKIJ in his study of gaseous exchanges in the root

The apparatus consisted of: 1) 2 glass "cloches" placed one above the other, the lower one of which was 75 cm. high and 30 cm. in diameter, and the upper one 76.5 cm. high and 31.5 cm. in diameter, that is to say between the two "cloches" there remained a space of 1.5 cm. for the reception of the root; 2) a dish of water to maintain the air moist between the two "cloches"; 3) two covers to protect the roots from the action of light and heat, the outer one being painted white. Throughout the experiment the apparatus remained in the open.

The roots of germinated grain of *Triticum durum* were introduced through an opening made in the top of the external "cloche". The walls of the chamber formed by those of the two cloches were always covered with water vapour derived from the dish. Mineral nutrition was assured by means of waterings at 1 ½ hour intervals (except at night when they were suspended) with a solution of: calcium nitrate, 1.5 gr. — monopotassic phosphate, 0.5 gr. — potassium chloride, 0.3 gr. — magnesium sulphate, 0.5 gr. — ferric hydrate, 5 drops — water, 1 litre. In order to prevent the nutritive solution from descending too rapidly a little glass-wool was placed around the neck of the root. This did not hinder observation. In these conditions the plant developed absolutely normally to maturity (formation of ripe grain). The first object of the experiments was thus attained. In subsequent researches, by dividing the space between the cloches into sections in the direction of their length, it will be possible to create varying conditions of nutrition and to investigate their influence on the development of the root. Further, by filling these sections with matter of varying density (sand, clay, charcoal, etc.), it will be possible to

letermine the manner in which the roots become distributed in the var ious media.

As regards the development of the functional portion of the root he writer records that, according to his preliminary experiments, the root airs develop in abundance in the moist air, but that after a time, notwithstanding the conservation of conditions equally favourable to their existence they die off. All this leads to the belief that the idea of taking he root system and considering data on its length, weight and general rea is not only one-sided but even erroneous, since two root systems of qual length may still differ in the number of their actively functional roots. Thus the writer considers that the length of the root system can no longer serve " among other data " as a sign of resistance to drought, according to the idea of MODESTOV (1). The best proof of this is to be found among MODESTOV'S own data on the length of the root system of pure strains of oats. Taking the length of the root system as a basis for selecting drought resistant plants, the " Gudan " and " Ghigantskij " varieties should undoubtedly be the best for dry regions. But practice shows the contrary is the case: thus, in the South-east of Russia, in 1911, a remarkably dry year, the varieties " rykhlik " and " nemertchansk " have, beyond all others, justified their reputation for drought resistance. But according to MODESTOV'S data it is precisely these varieties which have the shortest root system.

The writer considers the question may be resolved by determining the functional area of the root in the different varieties, and it will probably be found that this will be relatively greater in the varieties most resistant to drought.

A thorough study of the extent of the functional area of the root should help to elucidate several experimental facts which are still doubtful and should open up wide horizons in respect of questions relating to soil cultivation, irrigation and manuring.

1210- **Kafirin, an Alcohol-soluble Protein from Kafir (*Andropogon Sorghum*).** JOHNS CARL O. and BREWSTER J. F., in *The Journal of Biological Chemistry*, Vol. XXVIII, No. 1, pp. 59-65, Baltimore, Md., December, 1916.

Kafir has become an important crop in the United States during the ast decade. In 1910, three million acres were under cultivation, and the alue of the crop was thirty million dollars. It is known that this cereal ontains an alcohol-soluble protein, but hitherto no study has been reported n the proteins of kafir. The seeds used in the writers' experiments were rown in Kansas in 1915 and were of the variety known as dwarf kafir.

Nitrogen determinations on the Kafir meal showed that it contained 1.7 per cent. of protein (N × 6.25). Of this, boiling 60 per cent alcohol xtracted 7.9 per cent of protein, based on the nitrogen content of the xtract. 5.2 per cent of pure protein was isolated, dried at 110° C., by the se of alcohol ranging from 60 to 70 per cent by volume. As no account

(1) See *B.* 1916, No. 741. (*Ed.*)

was taken of the losses occurring in the various manipulations during the preparation of the protein, this yield indicates that most of the nitrogen extracted was in the form of protein. To this alcohol-soluble protein, which constitutes more than one-half of the protein in the seed, the name kafirin has been given. Kafirin resembles zein in its ultimate composition, but is different in physical properties. It contains tryptophane and apparently lysine, both of which are lacking in zein.

Analyses of 13 preparations of kafirin gave the following average results calculated on a moisture-free basis.

Analyses of Kafirin.

C	55.19 per cent.
H	7.36
N	16.44
S	0.60
O	20.41

The distribution of nitrogen was obtained from an analysis made by the VAN SLYKE method. A sample of kafirin containing 16.64 per cent of nitrogen gave the following results, from which it appears that this protein differs from zein in containing distinctly more amide nitrogen as well as basic nitrogen.

Distribution of Nitrogen in Kafirin and in Zein.

Nitrogen	Kafirin	Zein *
Humin	0.17	0.16
Amide	3.46	2.97
Basic	1.04	0.49
Non-basic	11.97	12.51
	16.64	16.13

* OSBORNE and HARRIS, *Journal of the American Chemical Society*, 1903, Vol. XXV, p. 3

The percentage of diamino-acids in kafirin was also determined by the Van Slyke method. The results given below have been corrected for 0.7 per cent of cystine, which was precipitated with the phosphotungstate of the other bases.

	Kafirin	Zein
Arginine	1.58	1.55
Lysine	0.90	0.00
Histidine	1.00	0.82
Tryptophane	Present	0.00

* OSBORNE and JONES, in *American Journal of Physiology*, 1910, XXVI, p. 228.

27- **Some Proteins from the Jack Bean, *Canavalia ensiformis.*** — JONES D. BREESE and JOHNS CAR O., in *The Journal of Biological Chemistry*, Vol. XXVIII, No. 1, pp. 67-75. Baltimore, Md., December, 1916.

The writers have isolated from the jack bean two globulins, canavalin and concanavalin. They have the following composition.

	Canavalin	Concanavalin
C	53.26	53.28
H	7.03	7.02
N	16.72	16.45
S	0.48	1.10
O	22.51	22.15

The distribution of nitrogen in canavalin and in the albumin is the following.

Nitrogen	Canavalin	Albumin
Humin	0.28	0.23
Amide	1.41	1.16
Basic	3.17	3.73
Non-basic	11.55	11.18
Total	16.41	16.30

- **The Proteins of the Peanut, *Arachis hypogaea*: The Globulins Arachin and Conarchin.** — JOHNS CARL O. and JONES, D. BREESE, in *The Journal of Biological Chemistry*, Vol. XXVIII, No. 1, pp. 77-87. Baltimore, Md., December, 1916.

The writers have isolated from the peanut two globulins, arachin and arachin. They have the following composition:

	Arachin	Conarchin
C	52.15	51.17
H	6.93	6.87
N	18.29	18.29
S	0.40	1.09
O	22.23	22.58

	Distribution of Nitrogen		
	in the Arachin	in the Conarchin	in the total Globulins
Amide	2.03	2.07	2.08
Humin	0.22	0.22	0.21
Basic	4.96	6.55	5.23
Non-basic	11.07	9.40	10.68
Total	18.28	18.24	18.20

The percentage of basic nitrogen in conarchin is the highest one rded for any seed.

From these results it seems probable that pea-nut presscake will prove

to be highly effective in supplementing food products made from cereals and other seeds whose proteins are deficient in the basic amino-acids. Feeding experiments are in progress to determine the nutritive value of combinations of peanut proteins with other proteins obtained from the more extensively used seeds.

129 - **The Occurrence and Physiological Significance of Flavone Derivatives in Plants.** – SHIBATA, K.; NAGAI, J. and KISHIDA M. in *The Journal of Biological Chemistry*, Vol XXVII, No. 1, pp. 92-108, table 1. Baltimore, Md., December, 1916.

The results of the present study are summarized as follows by the writers:

1. The general occurrence of flavone derivatives in the plant kingdom may be taken as established.

2. The occurrence of flavone derivatives in plants is almost exclusively limited to the epidermis and the peripheral parenchymatous layer of the aerial parts with few exceptions on record, in which a considerable amount is also found in the bark and the wood, as in *Myrica rubra*, *Quercus tinctoria*, *Morus tinctoria*, etc.

3. The amount of flavone derivatives contained in the plant tissue can be measured colorimetrically by means of comparing the intensity of reduction colour (anthocyanin) produced by an aqueous or alcoholic extract from the fresh as well as from preserved herbarium (dried) material.

4. It is assumed that flavone derivatives dissolved in the cell sap possess an important physical significance in absorbing ultra-violet rays of the sunlight, by which the living protoplasm and its biochemical agencies are protected from the injurious action of the rays.

5. The plausibility of the above assumption is justified by the result of extensive studies made on plants from alpine and tropical regions when the intensity of the rays considered is high. The plants which are grown in strong insolation are always rich in flavones, except those which are fully protected from the action of the excessive illumination by some means of a morphological and anatomical nature.

6. The green leaves of deciduous trees, which produce anthocyanin pigment in autumn, contain a considerable amount of flavones. The production of autumnal colour (anthocyanin) is due to the biochemical change, i. e. the reduction of already existing flavones in the leaf, initiated by the physiological condition at the end of the growing season of the year, without having special ecological significance.

130 - **Role of Ammonia in the Metabolism of Nitrogenous Substances in Plants.** I. PRIANICHNIKOV D. N. *Ammonia as alpha and omega of the metabolism of nitrogenous substances in the plant*, in *Московскій Сельскохозяйственный Институтъ Кафедра Частнаго Земледѣлія. Изъ результатовъ вегетаціонныхъ опытовъ и лабораторныхъ работъ* (*Agronomical Institute of Moscow. Collection of papers in the Agronomical Laboratory under the direction of Prof.* D. N. PRIANICHNIKOV). Vol. I pp. 1-24, Moscow 1916. — II. NICOLAIEVA A. G., *Accumulation of asparagine in young shoots of Lupinus luteus in conditions of nutrition with various ammoniacal salts.* Ibid. pp. 380-383. — III. MOROSOV V. A., *Influence of alkalinity of solutions on the metabolism of nitrogenous substances in young pea shoots.* *Ibid.*, pp. 384-390. — IV. PRIANICHNI

D. N. and KACHEVAROVA O. N., *Influence of carbohydrates on the behaviour of the lupin in connection with ammoniacal salts, influence of ether and other solvents of fats on the germination capacity of the seeds.* — V. KADLOUKOV A. S. *Influence of the removal of the endosperm on the behaviour of young maize shoots in connection with ammonical salts. Ibid.*, pp. 155-158.

In 1894, Prof. PRIANICHNIKOV readopted the point of view of BOUSSINGAULT with regard to asparagine as an amide analogous to urea, resulting from oxidisation processes and remaining unconsumed by the plant long as the latter remains in darkness (ordinary conditions of germination). In the present work, the author gives the following summary his researches during the last few years in the Laboratory of which he Director (1) on the rôle of ammonia in the metabolism of nitrogenous bstances :

(1) In the preface to his work M. PRIANICHNIKOV gives the following data on the work this Laboratory in 1914 in which 120 persons participated — students, assistants, specialists the Dept. of Agriculture, etc : (*Ed.*)

	Number of experiments	Number of pots
Experiments with various phosphorites (cereal cultures in sand)	8	130
Behaviour of various plants in relation to phosphorites	13	206
Action of fertilisers	15	253
Phosphates of iron (and other phosphates)	4	82
Influence of various forms and quantities of phosphoric anhydride	25	342
Influence of calcium carbonate on the assimilation of phosphoric acid	1	64
Importance of citric soluble phosphoric acid	13	62
Comparison between "normal" nutritive solutions	13	505
Sources of potash	12	170
Ratio lime: magnesia	10	160
Action of salts of briny soils	8	116
Lupins and lime	1	48
Assimilation of iron	1	64
Denitrification	8	100
Nitrogenous manures	7	198
Experiments with zeolites	1	18
Action of moisture	3	46
Ash of dried cattle manure	2	32
Repeated sowings (Soil fatigue)	2	400
Experiments with the object of studying farm yard manure	1	72
Stimulating fertilisers	4	102
Total	142	3080

The total number of 3080 pots may be analysed as follows :

253 water cultures
2198 sand
629 soil

Recent research has shown that ammonia plays an important part in the life of the higher plants, not merely as a point of departure in the synthesis of proteids but also as the end product of decomposition resulting from the oxidisation of nitrogenous substances. However, in the normal plant, ammonia does not accumulate in the tissues as such; it only gives rise, by means of a secondary synthesis, to the formation of asparagine. This processus serves to eliminate the ammonia injurious to the plant (ammonia derived from without as well as that formed within the cells), by transforming it into a neutral combination, capable of serving subsequently for a more complex synthesis.

The synthesis of asparagine at the expense of the ammonia absorbed by the roots is not accomplished with equal facility among all plants. Previous experiments at the above-mentioned laboratory have resulted in the distinction of 3 types of plants:

1st *Type*: Plants supporting well dilute solutions of ammonium chloride or ammonium sulphate, readily absorbing ammonia and forming asparagine or glutamine without any need for special precautions. Belonging to this group: *Hordeum sativum* — *Zea Mays* — *Cucurbita Pepo*.

TABLE I. — *Quantities and distribution of nitrogen in* 100 *plants of Hordeum sativum and of Cucurbita Pepo grown in distilled water and in a solution of ammonium chloride.*

	Hordeum sativum		*Cucurbita Pepo*	
	Distilled water	Ammonium chloride	Distilled water	Ammonium chloride
	—	—	—	—
Total nitrogen	145.8 mgr.	161.5 mgr.	1 438.3 mgr.	1 545.4 mgr.
Protein nitrogen	61.8	61.5	1 153.0	1 049.9
Asparagine nitrogen .	**36.7**	**56.4**	**193.3**	**379.3**
Ammoniacal nitrogen .	0.5	0.9	8.7	6.4

2nd *Type*: Plants in which solutions of ammoniacal salts of strong acids retard the decomposition of albuminoid substances and the accumulation of asparagine: absorption of ammonia is very feeble and sometimes almost *nil*, but on introducing calcium carbonate to the solution energetic absorption of ammonia and formation of asparagine is observed. To this type belong: *Pisum sativum* and *Vicia sativa*.

TABLE II. — *Quantities and distribution of nitrogen in* 100 *young plants of Vicia sativa and of Pisum sativum grown in: distilled water — solution of ammonium chloride — solution of ammonium with addition of calcium carbonate.*

	Vicia sativa			*Pisum sativum*		
	Distilled water	Ammonium chloride	Ammonium chloride + calcium carbonate	Distilled water	Ammonium chloride	Ammonium chloride + calcium carbonate
	—	—	—	—	—	—
Total Nitrogen	221 mgr.	244 mgr.	263 mgr.	1 608 mgr.	1 712 mgr.	1 810 mgr.
Protein nitrogen	85	100	90	949	1104	1010
Asparagine nitrogen .	**76**	**73**	**118**	**256**	**283**	**441**
Ammoniacal nitrogen . .	0.9	0.9	1	10	10	10

3rd *Type*: Plants in which nutrition with ammonical salts is capable of causing serious disturbances in the synthetic reactions which manifest themselves in the accumulation of ammonia derived from the decomposition of the nitrogenous substances in the seeds. In this case the addition of calcium carbonate is powerless to re-establish the normal course of the metabolism of nitrogenous substances. The yellow lupin (*Lupinus luteus*) may serve as an example of this type.

TABLE III. — *Quantities and distribution of nitrogen in* 100 *young plants of Lupinus luteus grown in: distilled water — solution of ammonium sulphate or ammonium chloride — ammonium sulphate or ammonium chloride solution with addition of calcium carbonate.*

	1st experiment			2nd experiment		
	Distilled water	$(NH_4)_2SO_4$	$(NH_4)_2SO_4$ + $CaCO_3$	Distilled water	NH_4Cl	NH_4Cl + $CaCO_3$
Total nitrogen	567 mgr.	575 mgr.	535 mgr.	540 mgr.	590 mgr.	417 mgr.
Protein nitrogen	152	160	170	194	209	165
Asparagine nitrogen	258	175	158	231	231	196
Ammoniacal nitrogen	26	57	68	9	9	2

Once these 3 types of plants had been established, the object of the ubsequent experiments was to explain the characteristic behaviour of the upin with regard to ammoniacal salts of strong acids: to ascertain, that ', whether the cause resides in the absence of carbohydrates, or, in the ase of this factor being of no account, what the real causes may be.

In order to elucidate the rôle played by the reserves of carbohydrates i the economy of the lupin, use may be made of various methods:

1) Choice of natural subjects analogous in the composition of their eds to the lupin, in order to control, by the aid of the constituents of ese seeds, the results of experiments made upon the lupin itself.

2) Artificial preparation of subjects analogous to the lupin.

3) Study of the influence of a special nutrition upon the lupin elf.

The following 2 methods were chosen:

A. — *Diminution of the reserves of carboydrates in Gramineae or in guminosae other than the lupin, in order to obtain another physiological be: an "artificial lupin"*

B. — *Increase of the carbohydrate reserves in the lupin itself.*

In both cases it was proposed to observe how such artificially obtained bjects behaved in relation to ammoniacal salts of strong acids.

Method A. — In order to apply this method, i. e. in order to obtain bjects of the lupin type from oil grains or grains rich in carbohydrates, e following methods are capable of being employed:

1) Physiological treatment of the seedlings (effect of inanition).

2) Mechanical removal of the endosperm or of the cotyledons, plants attaining a certain degree of development.

3) Extraction of the fatty matter of the grain in such a way as not deprive it of its vitality.

A. G. SMIRNOV has obtained satisfactory results with the first method. The normal behaviour of barley seedlings with regard to ammoniacal salts having been modified by the effects of inanition, the seedlings approached in character the physiological type of the lupin.

These experiments differ from earlier ones made in the same laboratory by G. S. CHOULOV with regard to the length of time the seedlings remained in the dark: this period was increased to 10-21 days. Table IV shows that the mixture of $NH_4Cl + CaCo_3$ occasioned a diminution in the quantity of asparagine relatively to that of plants grown in distilled water.

TABLE IV. — *Quantities and distribution of nitrogen in* 100 *seedlings of Hordeum sativum grown in various nutritive media* (*Experiments of* A. G. SMIRNOV).

Nutritive solutions	Total nitrogen	Protein nitrogen	Asparagin nitrogen	Ammoniacal nitrogen
Distilled water	163.3 mgr.	81.6 mgr.	44.8 mgr.	4.1 mgr.
NH_4Cl	202.1	95.5	37.5	44.2
$NH_4Cl + CaCo_3$	242.1	86.8	37.4 —>	72.0
$NH_4Cl + CaSo_4$	226.4	83.2	26.1 —>	69.2
NH_4NO_3	188.6	77.1	60.0 <	17.2
Urea	171.0	68.5	66.8 <	10.3

The quantity of ammoniacal nitrogen is about twice as great as that of asparagine nitrogen. The same results are obtained with the mixture $NH_4Cl + Ca\,So_4$. There are consequently, in this case, symptoms highly characteristic of the lupin, which are not present in the barley during the early days of its development.

With regard to ammonium nitrate and urea, they have given results analogous to those obtained by MLLE. NICOLAIEVA with the lupin, viz. these two sources of nitrogen have not altered the asparagine synthesis.

A control experiment carried out by A. I. SMIRNOV, where the plants were gathered at two different periods, entirely confirmed the data obtained from a comparison of the results of the experiments summarised in Table IV with those of CHOULOV.

TABLE V. — *Quantities and distribution of nitrogen in* 100 *seedlings of Hordeum sativum grown in various nutritive media and gathered after* 11 *and* 21 *days respectively* (A. G. SMIRNOV'S *experiments*).

	Nutritive solutions	Total nitrogen	Protein nitrogen	Asparagin nitrogen	Ammoniacal nitrogen
11 days	Distilled water	164.4 mgr.	101.2 mgr.	16.3 mgr.	5.4 mgr.
	NH_4Cl	181.2	104.1	33.0 <	11.7
	$NH_4Cl + CaCo_3$	187.3	98.9	38.8 <—	13.3
	$NH_4Cl + CaSo_4$	190.8	97.2	33.8 <—	8.1
21 days	Distilled water	164.9	73.8	36.6	7.6
	$NH_4Cl + CaSo_4$	200.2	70.6	28.0 —>	51.0

Table V shows that the 11 day seedlings have retained their " barley " type (accumulation of asparagin at the expense of ammonia), and that those of 21 days already show the " lupin " type (accumulation of ammonia at the expense of asparagine).

With regard to the experiments with the 2nd method : diminution of the starch reserves by removal of the cotyledons or the endosperm, these were carried out on peas and on maize grains. At present only the results of KABLOUKOV's experiments can be quoted, made on maize seedlings which grew in nutritive solutions for 2 weeks after removal of the endosperm.

TABLE VI. — *Quantities and distribution of nitrogen in* 100 *seedlings of Zea Mays grown in nutritive solutions for* 2 *weeks after removal of the endosperm.*

Nutritive solutions	Asparagin nitrogen	Ammoniacal nitrogen
Distilled water.	28.66 mgr.	6.44 mgr.
NH_4Cl.	28.22	14.40
$NH_4Cl + CaCo_3$	39.44	23,00

These results lead to the belief that the duration of the experiments was insufficient : thus with regard to asparagin storage the maize gave the " pea " type, but not yet the " lupin " type ; on the one hand no diminution of asparagine was observed ; on the other, ammonium chloride alone added to the solution did not bring about asparagine synthesis ; to obtain this latter it was necessary to add Ca Co_3. — With regard to the figures in the 2nd column it must be admitted that such an enormous increase of ammonia is not usually observed either in maize or in the pea, and that, in this connection, there is resemblance to the " lupin " type.

Experiments were also made based on the 3rd method : extraction of the fats from the seeds of oil-plants by means of ether, in order to ascertain if complete dessication does or does not preserve the grains from the harmful influence of ether or chloroform, as it does undoubtedly protect them from the effects of high temperatures.

The first experiments made by MLLE KACHEVAROV seemed to promise useful results : dried seeds of sunflower deprived of their woody coats and left for a month in ether gave up 50 % of their fat to the solvent and 50 % retained their germination capacity ; some even retained it after a whole year in ether.

It was important to know whether these results were not due to the fact that some of the seeds (50 %) were permeable to the ether which dissolved out their fats and thus destroyed their germinating power, whilst others (50 %) remained impermeable to the ether and thus retained their fats and capacity for germination. Subsequent experiments showed that such was indeed the case, for the seeds whose coats were perforated on the side opposite to the germ lost their germinative capacity, in spite of complete drying in the oven and treatment with ether dehydrated

with phosphoric anhydride. However that may be, the experiments on barley, in a state of inanition (quoted above) are sufficient te give an affirmative reply to the question studied following method A; in other words, as a result of their loss of carbonydrates the Gramineae behave, in relation to ammoniacal salts, in the same way as plants of the "lupin" type.

Method B. — The question was also put in inverse fashion: can increase in the carbohydrate reserves in the lupin itself modifiy its behaviour with regard to ammoniacal salts in the sense of an approaching similarity to the "barley" type.

Two methods were used to increase the proportion of carbohydrates in lupin seedlings: one consists in carrying out the experiments in the light under conditions favourable to assimilation; the other consists in nourishing the seedlings with glucose.

As early as 1895 SUZUKI had performed experiments with ammoniacal salts in the presence of light but without determining the ammonia, a fact which induced MLLE. KACHEVAROV to repeat the experiments in 1914, in sand cultures.

As it was difficult to foretell the moment where assimilation would be sufficient, and as it was also necessary to ensure the plants' obtaining sufficient reserves of ammoniacal salts, while avoiding an excess of NH_4Cl, the plants were gathered at 3 different periods (after 5-10-15 days exposure to light) and the ammoniacal salt was administered in 3 equal doses.

The results of this experiment showed that assimilation took place and at the same time the lupin had lost its characteristic behaviour towards ammoniacal salts, that is to say, the addition of ammonium chloride alone had brought about a notable increase of asparagine; further, similarly to what is oserved in the case of barley grown in the dark (and contrary to what takes place in the lupin in the same conditions), an energetic transformation of ammoniacal nitrogen to asparagin nitrogen was observed in the lupin. Thus when the intake of carbon is made superior to the outgo of this element there is a parallel modification in the behaviour of young lupin seedlings with regard to ammoniacal salts. The "asparagine to ammonia" movement is replaced by the reverse "ammonia to asparagine" movement.

The question, whether the characteristic behaviour of the lupin towards ammoniacal salts of strong acids depends on the insufficient quantity of carbohydrates at its disposal, has been answered in a manner favourable to the idea of a relation between this phenomenon and the quantity of carbohydrates or their accessibility to the plant. It has been seen that by increasing or diminishing the quantity of carbohydrates supplied to the plants it has been possible to cause them to pass from one type to another, so that all plants possessing sufficient resources in carbohydrates appear to have the power of forming asparagine at the expense of ammoniacal salts. On the other hand, in a state of inanition, they become unstable and easily lose the faculty of forming asparagin, evidently on account of the lack of carbon and of the necessity in which they are pla

ced of continuing the consumption of the chain of still unoxidised carbon atoms which occurs in asparagin and which is necessary to its synthesis.

In the presence of nutritional phenomena pushed to an extreme the characteristics of the species almost disappear and, instead of speaking of the " barley " type, it is permissible to talk in more general fashion of the behaviour shown with regard to ammoniacal salts of vegetable organisms " glutted " with or " starved " of carbohydrates.

The animal organism is more capable than the plant of protecting itself n economic manner against the harmful influence of ammonia, the common end-product of the katabolism of the proteid molecule : the animal liminates ammonia as urea which contains no more unoxidised carbon nd can be excreted without any detriment to the organism (from the point of view of calories). The higher plants, which are usually placed in better conditions than animals with regard to obtaining carbohydrates, allow themselves the luxury of forming an amide rich in carbon asparagine, which in normal conditions may accumulate in the cell sap without causing damage to the plant until a still greater affluence of carbohydrates allows the plant to draw upon the nitrogen of the asparagin in order to form proteins. If, on the other hand, these conditions re lacking, if the plant enters on a period of extreme " fast ", then it finds self in worse circumstances than the animal, because it cannot burn he chain of carbon atoms with impunity till complete extinction : incapale of taking the process as low as urea, it may die of auto-intoxication efore starvation has produced its fatal effects.

If the lupin runs more risk in this connection than other plants, it is ecause the ratio in its seeds, between proteids and carbohydrates, is wice as narrow as in the pea and four times as narrow as in the Gramineae.

31 – **Relation Between Alkalinity of the Cultural Medium and Plant Yield. Experiments made in Russia.** — I. Жемчужниковъ, Е. А. (Gemtchougenikov, E. A.). The Relation Between Alkalinity and the Yield of Plants Repeatedly Sown in Sand, in *Московскій Сельскохозяйственный Институтъ. Каѳедра Частнаго Земледѣлія. Изъ результатовъ вегетационныхъ, опытовъ и лабораторныхъ работъ. Томъ X, подъ редакціей профессора Д. Н. Прянишникова* (Moscow Agricultural Institute, Report of the work of the Agricultural Laboratory under the direction of Professor D. N. Prianichnikov) Year 19, Vol. X, pp. 337-351 + 1 diagram, Moscow, 1916. — Якушкинъ Л. В. (Jakouchkine, I. V.) Supplement to E. A. Gemtchougenikov's article, *Ibid.*, pp. 352-354.

In his experiments in 1914, M. Gemtchougenikov tried to obtain e conditions necessary to explain the effect of the accumulation of bases sand cultures without having recourse to any direct estimation of the alinity of the nutritive substratum.

These conditions were obtained in 2 ways : *A*) by modifiying the nutrie solutions. *B*) by choosing suitable plants.

A. — Modification of nutritive solutions. — 1) A start was made ith Hellriegels' solution which contains per litre : 0.31 gr. monopotassic osphate — 1.1 gr. calcium nitrate — 0.17 gr. potassium chloride —

0.13 gr. magnesium sulphate — 0.05 gr. ferric chloride. This solution produced an excess of bases.

2) If it is the excess of bases which exercises the chief action, the plants should suffer most in the most alkaline solutions. As an "alkaline" solution, one was selected containing per litre 0.55 gr. calcium nitrate — 0.68 gr. potassium nitrate — 0.31 gr. monopotassic phosphate — 0.13 gr magnesium sulphate — 0.05 gr. ferric chloride — and in which the amount of each of the nitrates corresponded to the same quantity of nitrogen.

On the other hand, if this view is correct, everything that decreases the alkalinity of HELLRIEGELS' solution should also lessen the inconvenience caused to the plant. With regard to this point the following solutions were employed:

3) PRIANICHNIKOV'S nutritive solution, which is regarded as neutral and contains per litre: 0.39 gr. of bicalcic phosphate — 0.54 gr. ammonium nitrate — 0.77 gr. calcium sulphate — 0.34 gr. potassium chloride — 0.13 gr. magnesium sulphate — 0.05 gr. ferric chloride.

4) The so-called "acid" solution containing per litre: 0.31 gr. monopotassic phosphate — 0.54 gr. ammonium nitrate — 0.17 gr. potassium chloride — 1.16 gr. calcium sulphate — 0.13 g. magnesium sulphate — 0.05 gr. ferric chloride. This solution gives an acid reaction, at least, when the plants begin to grow.

5) HELLRIEGEL'S solution acidifiedb y the substitution of 0.30 gr of superphosphate for 0.31 gr. of monopotassic phosphate.

In addition to these 5 solutions, the following was also employed.

6) CRONE'S nutritive solution containing per litre: 2.25 gr. potassium nitrate — 1.12 gr. magnesium sulphate — 0.56 gr. tricalcic phosphate — 0.56 gr. iron phosphate — 1.12 gr. calcium sulphate.

B. — CHOICE OF SUITABLE PLANTS. — As fundamental species were selected: *Camelina sativa* which cannot stand repeated sowing in HELLRIEGELS' solution, and *Lupinus luteus* which, on account of its tendency to increase the acid content of the medium in which it is grown, belongs to another category of plants. The experiments, indeed, proved that the lupin had scarcely suffered at all from the repeated sowing.

As successors to *Camelina sativa*, and in order to correct the alkalinity of the soil due to the latter, were sown other plants such as buckwheat and hemp which behave in a manner similar to the lupin.

The first sowing took place at the end of May, there being 3 sowings in all, at an interval of about 1 month. After each harvest, 200 gr. of sand were taken from each pot (containing 4.5 kg. of sand) in order to estimate its alkalinity.

The same amount of fresh sand was added, together with a new supply of nutritive solution for the support of the next crop.

The hemp and buckwheat succeeded *Camelina sativa* in HELLRIEGEL solution, but in the solutions with decreased or increased alkalinity, *Camelina sativa* was again planted. Finally, at the 3rd sowing, *C. sativa* replaced all plants which had been used to prepare the medium for it.

In the case of the lupin, the above-mentioned combinations were

somewhat different. CRONE'S solution was taken as the basis, and in this medium the plant grew well. The group of acid solutions was excluded, since it was of no interest as regards the lupin. In CRONE'S solution, the latter plant was succeded by: *Camelina sativa*, *Pisum sativum* and buckwheat.

It was to be expected that, as the lupin accumulates no bases, *C. sativum*, being very susceptible to these compounds, would grow after it very well.

Conclusions. — In all the pots from which a 2nd crop was gathered, the alkalinity of the solution at the time was considerably greater than at the date of the first crop.

In a given pot, the 2nd and 3rd crops were sometimes larger than the 1st.

The amount of the 2nd and 3rd crops depended upon the alkalinity left by the preceding plants; the greater the alkalinity of the soil, the poorer the yield, and *vice-versa*.

This accumulated alkalinity would explain to some extent, if not entirely, the decrease in yield observed when plants are repeatedly sown in ind cultures.

II. — In analysing the results of the above-mentioned experiments, I. JAKOUCHKINE draws attention to the circumstance, that in many cases, ıcts observed were in accordance with expectation. Thus for instance, on omparing the development of plants sown at the same time, the following ıcts were noted: at the 2nd sowing, the crop produced by *C. sativa* in the lkaline solution was three times less, and the yield was only ¼ less in 'RIANICHNIKOV'S solution, while in HELLRIEGEL'S solution acidified by superphosphate the yield was increased 5 per cent. On the other hand, the owing in CRONE'S solution came to nothing.

On comparing the results of the 2nd and 3rd sowings, it was found hat: in the alkaline solution the yield of the 3rd sowing was twice less, hile in the acid solution the 2nd and 3rd sowings produced equal crops nd finally in PRIANICHNIKOV'S solution the 3rd sowing even produced a mewhat larger yield.

In the case of the lupin, about the same relations were found to exist etween the effects of the different solutions. Thus in the 2nd sowing the op raised in the alkaline solution showed a decrease (— 12 per cent), while at raised in PRIANICHNIKOV'S solution showed an increase (+ 10 per cent). nly in the case of the alkaline solution was any decrease observed between ie yield of the 2nd and 3rd sowings. It was found that the lupin redus to a certain extent the accumulation of bases in the nutritive solution, ving to its property of increasing the acid content of the solution.

The differences between the other plants tested were less marked.

M. JAKOUCHKINE points out that the principal conclusion to be drawn om M. GEMTCHOUGHENIKOV'S experiments is that all modifications hich hinder the accumulation of bases in the solution in which the plant growing, are of assistance to it.

132 - **Effect on Plant Growth of Sodium Salts in the Soil.** — HEADLEY F. B., CURTIS, R. W and SCOFIELD, C. S. in *Journal of Agricultural Research*, Vol. VI, No. 22, pp. 857-869, fig. 1-8. Washington, D. C., August, 28, 1916.

In connection with an attempt to utilise for crop production certain salt land on the Truckee-Carson Field Station at Fallon, (Nevada, United States), it has been necessary to make numerous determinations as to the limit of the salt content tolerated by crop plants. These determinations have shown that this limit of tolerance is extremely variable. Not only is it influenced by many factors, such as the nature of the soil, the kind of salt, and the species of plant, but the same crop plant shows marked differences in tolerance at different periods of its growth. These facts make the problem of the efficient reclamation of alkaline land a very difficult one.

In the present instance, the most abundant and deleterious salts are those of sodium and they occur as carbonates, bicarbonates, chlorides and sulphates. As the proportions in which these salts are found in the different parts of the Field Station are very variable, the writers thought it necessary to carry out a series of pot cultures with wheat; they used soil to which had been added known quantities of these different salts.

These laboratory experiments brought out the fact that only a part of the salt added to the soil in pot cultures could later be recovered from it by water digestion. This apparent loss of salt, which was probably due to absorption by the soil, was greater in the case of sodium carbonate and sodium sulphate than with sodium chloride. The absorption of sodium carbonate was greater in fine soil, rich in organic matter, than in sand. The limit of tolerance for crop plants to the salt in the soil is determined by the quantity of salt that can be recovered from the soil, rather than by the quantity added to the soil. The carbonates and bicarbonates of sodium are mutually interchangeable and the toxicity of the soil solution appears to depend upon the quantity of the basic radical regardless of the form of the acid radical. In the case of the soil from the field under consideration, the proportion of recoverable salt which would reduce by one half the growth of wheat seedlings (which represents the critical point of toxicity) was for the carbonates 0.04 per cent of the dry weight of the soil; for the chlorides 0.16 per cent and for the sulphates, 0.35 per cent.

On the other hand, the proportion of the recoverable salt which prevented germination of wheat was, for the carbonates 0.13 per cent, for the chlorides 0.52 per cent, and for the sulphates 0.56 per cent.

133 - **The Function of Calcium in the Nutrition of Garden Pea Seedlings with Ammoniacal Salts.** — МОРОЗОВЪ, В. А. (MOROSOV, V. A.), in *Московскій Сельскохозяйственный Институтъ. Каѳедра Частнаго Земледѣлія. Изъ результатовъ вегетаціонныхъ опытовъ и лабораторныхъ работъ* (*Moscow Institute of Agriculture, Papers from the Laboratory of Prof. Prianichnikov*) Vol. X, pp. 391-395. Moscow 1916.

Experiments on the assimilation of ammoniacal salts by seedlings in the dark show that the accumulation of asparagine in the young plant occurs at the expense of the ammonia absorbed from without. Ammoniacal salts belong to the group of physiologically acid salts which are

ntegrally absorbed by the roots of the plant, but which, under their in-luence, split up into a base and an acid. The base is absorbed and the cid remains. Consequently it is obvious that ammoniacal salts, in this ase the sulphate, can only be of nutritive value to the plant where the cid radical is neutralised by a base.

In the present experiments the following nutritive solutions were used: ater — ammonium sulphate — ammonium sulphate + calcium carbonate - ammonium sulphate + ferric hydrate.

Calcium carbonate and ferric hydrate were thus employed to neutra-ise the acidity in order to study whether the action of the former is confin-d merely to the neutralisation of the environment or whether it exercises ny special action through the nutritive properties of calcium as such. The experiment was carried out as follows: seeds of the Garden pea (*Pisum ativum* var. *saccharatum*) were allowed to swell in distilled water for 24 ours and germinated on paper. When the roots were 3 to 4 cms. in length he seedlings were transferred to vessels containing the above named nu-ritive solutions, and at the end of a fortnight removed, dried and weighed.

Comparison of the average lengths of roots, stems and weight of oots, stems and weight of 100 germs, shows that the best development as obtained in the vessels containing calcium carbonate; next came ferric ydrate, then distilled water and finally the pure solution of ammonium ulphate.

In the dried seedlings determination was made of the protein nitro-en, asparagine nitrogen, ammoniacal and total nitrogen. The results re summarised in the appended Table.

utritive solutions	Total Nitrogen		Protein Nitrogen		Asparagine Nitrogen		Ammoniacal Nitrogen	
	%	Absolute quantity in 100 seedlings	%	Absolute quantity in 100 seedlings	%	Absolute quantity in 100 seedlings	%	Absolute quantity in 100 seedlings
illed water . . .	4.50	1179.20 gr	2.32	607.85 gr	1.30	340.60 gr	0.03	7.86 gr
solution d'ammo-um sulphate. . .	4.50	1220.15	2.40	652.52	1.18	312.99	0.03	8.55
onium sulphate ferric hydrate . .	4.91	1229.01	2.37	593.22	1.58	395.48	0.03	7.50
onium sulphate alcium carbonate	5.91	1241.84	1.84	240.25	2.02	483.33	0.02	7.78

This Table shows that the accumulation of ammonia occurs in oppo-sense to that followed by asparagine. The substitution of calcium car-ate by ferric hydrate was of advantage, but the action of the former more energetic. Probably calcium carbonate does not act merely as

a neutraliser of the medium but account must also be taken of the calcium which, occuring in easily assimilable form in the solution, increases the metabolism of the plant.

134 - **Daily Transpiration During the Normal Growth Period and Its Correlation with the Weather.** — BRIGGS, L. J. (Biophysicist in Charge, Biophysical Investigations, Bureau of Industry, U. S. Dept. of Agriculture) and SHANTZ, H. L. (Plant Physiologist, Alkali and Drought Resistant Plant Investigations, Bureau of Plant Industry, U. S. Dept. of Agriculture). *Journal of Agricultural Research*, Vol. VII, No. 4, pp. 156-212, figs. 1-23, pls. 5-6. Washington, D. C., 1916.

This paper deals with crop plants transpiration studies at Akron, Colo. during the summers of 1914 and 1915 ; the principal objects being the determination of the march of transpiration during the growth period, and the extent to which the daily transpiration is correlated with various weather factors.

The crop plants included in the experiments were grown in large pots (115 kg. of soils) and sealed to prevent evaporation from the soil surface. The pots were weighed each morning before the transpiration responses to sunlight had set in. Six pots of each crop were used in the determinations and were weighed to 0.1 kg. Twenty-one crops (126 pots) were included in the 1914 measurement and 23 crops (128 pots) in 1915. The plants used in 1914 transpiration measurements were :

Kubanka and Galgalos wheat, Swedish Select and Burt oat, Hannchen barley, spring rye, cowpea, white lupine, Kursk and Siberian Millet, Northwestern Dent and Algerian Minnesota and Dakota Amber sorghum, Sudan grass screened and in open, amaranth, Grimm alfalfa E 23-20-52, Grimm Alfalfa E 23 screened and in open, Grimm alfalfa 162-98 A.

Those used in 1915 were :

Kubanka, Galgalos, Washington, Bluestem, Turkestan, Marquis, Kubanka and Pearl wheat, Swedish Select and Burt oat, Hannchen barley, spring rye, North Dakota C. I. 13 and C. I. 19, Smyrna Flax, cowpea, millet, sorghum, corn, potato, amaranth, Sudan grass, Grimm alfalfa E 23 and 162-98 A_1.

Continuous automatic records were also obtained of air temperature, solar radiation, wet-bulb depression, wind velocity, evaporation from a shallow tank and evaporation from a deep tank. The climatic conditions were exceptionally uniform throughout the season of 1914. The summer of 1915 was unusually rainy.

During a 10-day period of maximum transpiration the annual crop lost about one-fourth of the total water lost during the season. The alfalfa lost during this period almost one-half of the total water transpired in the production of the second crop.

During a 10-day period of maximum transpiration the daily loss of wazer from the small grains ranged from 12 to 16 times the dry weight of the crop ; millets, corn, and sorghums, 6 to 9 times ; and alfalfas, 30 to 56 times the dry weight harvested. On the basis of a production of 1 ton of dry matter per acre this would correspond in the case of the small grain

o a daily loss of 0.11 to 0.14 acre-inch of water ; corn, millet, and sorghum, .05 to 0.08 acre-inch ; and alfalfas, 0.32 to 0.49 acre-inch.

The loss of water from the small grains during the period of maximum ranspiration amounted to 1.5 kg. per square meter of plant surface per lay ; Sudan grass, 0.8 kg. and alfalfa, 1.6 kg. This is from 5 to 14 per ent of the loss during the same period from a free water surface of equal rea.

The transpiration of the different crop plants per unit area of plant urface shows less variation than the transpiration per unit weight of dry natter. In other words, the greater efficiency shown by certain plants in he use of water appears to be due more to a reduction in plant surface han to a reduction in transpiration per unit area of surface. The direct olar radiation received by the plants at Akron is usually not sufficient to ccount for the observed transpiration during the midday hours. In some f the small grains the energy dissipated through transpiration is twice he amount received directly from the sun.

The march of the transpiration due to changes in the plant alone hange in the transpiration coefficient) may be expressed by the ratio of the aily transpiration to the daily evaporation, if we assume the latter to constitute a perfect summation of the weather conditions determining transpiration. The transpiration of the annual crop plants (aside from fluctuations due to weather) rises to a maximum a little beyond the middle of he growth period and then decreases until the plants are harvested. Perennial forage crop such as alfalfa increase steadily in transpiration to a aximum at or near the time of cutting. Various crops show their individuality by departing more or less from these types.

The transpiration coefficient of many of the crops increases exponenlly during the early stages of growth. Sudan grass, for example, doubled s transpiration coefficient every four days during the early growth riod. Alfalfat hroughout practically the whole period between cuttings ubled its transpiration every eight days. The relative change in the transpiration coefficients of two crops may be determined by taking the ratio the transpiration of the two crops day by day without the necessity of recting for changes in weather.

The correlation has been determined between the various physical ctors of environment and the transpiration of the different crops, consid both individually and as one population The correlation coefficients the latter case for the season of 1914 are as follows: Transpiration with diation, 0.50 + 0.01 ; with temperature, 0.04 + 0.01, wet-bulb depression, 9 + 0.01 ; with evaporation (shallow tank), 0.72 + 0.01 ; with evaporan (deep tank), 0.63 + 0.01 ; and with wind velocity, 0.26 + 0.01.

The small grains show individually a markedly higher correlation beeen transpiration and the intensity of the various physical factors than s observed when all the crops were combined in one population. The an correlation coefficients for the small grains (1914) are as follows: anspiration with radiation, 0.65 ; with temperature, 0.71; with wet bulb

depression, 0.88; with evaporation (shallow tank), 0.87; with evaporation (deep tank), 0.75; with wind velocity, 0.22.

The corn, sorghum, and millet group and the legume group show a somewhat lower correlation between transpiration and the intensity of the physical factors of environment. The plants in the various groups, however, show the same relative dependence of transpiration upon the physical factors. Wet-bulb depression and evaporation (shallow tank) exhibit the highest correlation with transpiration in all cases, while wind velocity is correlated with transpiration to a very slight extent at Akron.

The degree of dependence of transpiration of the small grains in 1914 upon radiation temperature, wet bulb depression and wind velocity, considered as independent causative factors, as shown by the squares of the correlation coefficients is as follows: Wet-bulb depression, 0.77; temperature, 0.50; radiation, 0.42; and wind velocity, 0.05. Since the sum of these squares exceeds unity, the physical factors are evidently intercorrelated. The association of transpiration of the small grains with evaporation (shallow tank) is 0.76, or the same as with wet bulb depression.

135 - **"Fylgia", "Extra Squarehead III", "Sol II", "Pansar", "Thule II" Varieties of Wheat selected at Svalöf, Sweden.** — NILSSON-EHLE, H.; in *Sveriges Utsädes forenings Tidskrift*, Year XXVI, Part 3, pp. 97-101; 106-108; 109-112; 1 Plate; 113-114; 115-118. Malmoë, 1916.

The "Fylgia" variety of wheat, which has been selected and cultivated for a long experimental period at Svalöf, is now grown on a large scale, and is deservedly a favourite with all the farmers of Scania (south Sweden). With the exception of "Pansar", a variety which is equally productive, "Fylgia" is, as regards grain yield, distinctly superior to the most commonly cultivated types of wheat, as is shown by the following figures: "Fylgia" 4 294 kg. per ha. (1). — "Pansar" 4292 kg. — "Tystofte" Smaahvede" 4 202 kg. — "Sol" 3 964 kg. — "Extra Squarehead II" 3 826 kg. — "Weibulls Iduna" 3 758 kg. These data represent the average result of 33 series of experiments in cultivation carried out in the 2 districts of Malmöhus and Kristianstad (Skåne), during the period 1911-1915. They show that the "Fylgia" variety surpasses the others by 400 kg. per ha. on an average — a by no means negligible figure. The types "Fylgia" and "Pansar", on the other hand, are equal, and each enjoys priority according to the weather, or the local soil conditions.

Preference should be given to the "Pansar" variety on stiff cold clays which are unsuitable for "Fylgia", a wheat requiring a light warm soil. Thus at Svalöf, where impermeable, heavy soils predominate, "Pansar" gives the larger crop.

TABLE I. — *Comparative grain yields per hectare of the varieties "Pansar" and "Fylgia" at Svalöf during the period* 1912-1915.

Varieties	1912	1913	1914	1915	Average	Relative Productivity
"Pansar" . .	4 950 kg.	6 160 kg.	4 670 kg.	5 830 kg.	5 400 kg.	106.5
"Fylgia" . .	4 750	5 980	4 570	4 970	5 070	100.0

(1) 1 000 kilos per hectare = 7.965 cwt. per acre. [*Ed.*]

These two types of wheat are also distinguished from one another by their growth period, " Fylgia " being the first to ripen. This is a great advantage, for it is always useful, on large farms, to have varieties which are equally productive, but ripen at different times for it facilitates harvest operations, by allowing them to be divided. The superiority of the " Fylgia " variety over the " Smaahvede ", which is due to its greater resistance to cold, was especially apparent in 1915 in Östergotland, where the winter being very severe, " Fylgia " exceeded " Smaahvede " in grain yield by 25 per cent. The yields given in Table II, were obtained at Svalöf during the period 1912-1915

TABLE II. — *Comparative grain yields per hectare of the varieties " Fylgia " and " Smaahvede " at Svalöf, during the period* 1912-1915.

Varieties	1912	1913	1914	1915	Average	Relative Productivity
" Fylgia " . .	4 750 kg	5 980 kg.	4 570 kg.	4 970 kg.	5 070 kg.	101,5
" Smaahvede .	4 350	5 830	4 600	5 130	4 980	100.0

As is well known, " Fylgia " is the result of crossing " Extra Squarehead II " with " Tystofte Smaahvede ". The first of these varieties is distinguished by its cold resistance and the elasticity of its straw and the second, by its large yield and resistance to rust. That wheats can be improved by selection, is shown by the " Fylgia " hybrid which, while it unites in itself the best characters of its parents, surpasses them both in yield, and is an excellent type of a prolific and cold resistant variety. In reality " Fylgia " might be termed an acclimatised " Smaahvede ". The former is not only distinguished by its large yield, but also by the great weight of the grain per hectolitre, it is only inferior to " Sol " in this respect, as is seen from Table III.

TABLE III. — *Comparative weights of* 1 *hectolitre* (1) *of grain of different kinds of wheat at Svalöf during the period* 1913-1915.

Varieties	1913	1914	1915	Average
" Fylgia "	80,7 kg.	75,6 kg.	79,0 kg.	78,4
" Smaahvede "	80,0	77,1	79,4	78,8
" Sol "	79,0	77,9	79,7	79,0
" Extra Square-head II " . .	78,3	74,0	77,2	76,5

" Fylgia ", like " Pansar " is one of the best types for Scania, and could also certainly be cultivated with advantage in other districts of south Sweden: Blekinge, St. Kalmar, Öland and Gotland.. The variety " Extra-Squarehead II ", was cultivated on an extensive scale in 1909 : it has spread rapidly to Scania, principally on account of the characteristic strength of its haulms. Of late years, other more productive types (" Fylgia ", " Pansar "), have gradually appeared on the markets and have been generally

(1) 1 hectolitre = 2.751 bushels. (*Ed.*)

grown, none of them however, could compete with " Extra-Squarehead " from the point of view of the strength of the straw. On the other hand, the crossing experiments carried out for the purpose of combining in one individual the character of " Extra Squarehead " and the productivity of other types, did not give positive results. It was therefore thought best at Svalöf to experiment further with the " Extra Squarehead II " variety with the object of increasing its productivity without lessening the strength of the straw.

" Extra-Squarehead II " is the result of crossing the varieties " Extra Squarehead I " and " Grenadier I ". The former is distinguished by its resistance to cold and rust, and the latter by its strong straw and high yield. The hybrid combines the positive characters of both parents, but they are not combined in the best possible manner. Experience has shown that certain characters (in this instance, productivity) are not only correlated with a single element, but often with several. Thus, it may well happen that " Extra Squarehead II " only contains some of the determinant (those giving rise to productivity) which are present in " Grenadier ", in which case, the latter variety would be a good type to use in further selection.

For this reason, the writer tried to make a 2nd cross, this time between " Extra Squarehead II " and the parent variety " Grenadier ". The immediate results were as he had foreseen, for in spite of the close relationship existing between " Grenadier " and " Extra Squarehead II ", the hybrids of the 1st and 2nd generations presented many variations and new combinations, some of which were of practical importance. This was especially the case as regards the line 0881 which came into general cultivation in 1916, under the name of " Extra-Squarehead III ". This new variety combines strength of straw with greater productivity than is shown by " Extra Squarehead II ", as is proved by the comparative cultural experiments made at Svalöf during the period 1912-1915. (See Table IV).

TABLE IV. — *Yield of grain per hectare produced by " Extra Squarehead III " and " Extra Squarehead II " at Svalöf during the period* 1912-1915.

Varieties	1912	1913	1914	1915	Average	Comparative Index
" Extra Square-head III " . . .	4 390 kg.	5 560 kg.	4 460 kg.	4 646 kg.	4 763 kg.	[illegible]
" Extra Square-rehead II " . .	4 010	5 500	4 330	4 749	4 645	[illegible]

An improvement is noticeable not only in the yield, but also in the gra weight per hectolitre. (See Table V).

TABLE V. — — *Weight of 1 hectolitre of grain produced by the varieties " Ex Squarehead III " and " Extra Squarehead II " at Svalöf during the pe iod* 1912-1915.

Varieties	1912	1913	1914	1915	Average
" Extra Square-head III "	76.8 kg.	79.2	76.3	79.7	[illegible]
" Extra Square-head II ".	75.2	78.3	74.0	77.2	[illegible]

The creation of " Extra Squarehead III " is also, of some historical importance, for it is the first variety of wheat obtained at Svalöf by crossing a hybrid with one of its parents.

This new type does very well in Scania and also, naturally, in all regions where similar conditions of climate and soil exist. " Fylgia " and " Pansar " are, without doubt, the types of wheat best adapted to Scania and the " Pansar " variety at all events, might be successfully introduced into Central Sweden for, in different places in the centre of the country, it has shown a high degree of resistance to cold. This wheat, however, ripens very late, and the further north it is planted (especially in districts with cold damp summer) the more this fact influences the quality of the grain which never attains complete maturity, and consequently its weight per hectolitre is rather low.

Hence, it is necessary to produce early ripening varieties for central Sweden. " Sol " is fairly resistant to cold, it ripens quickly and gives a high yield, thus apparently fulfilling all requirements. Its grain, however, has the defect, when sown in autumn, of germinating very late and in an irregular manner, so that when the cold weather sets in and arrests the growth of the young plants, the latter are still weak and not uniform, which has a bad effect upon the successive phases of development and also upon the harvest.

In order to correct this defect an attempt was made to cross " Sol " with " Extra Squarehead II "; the hybridisations were carried out on such a large scale between 1900 and 1913 that at the 4th generation, the hybrids already filled 226 experiment plots. The very hard winter of 1912 was favourable to the selection of individuals with the greatest cold resistance, as the plants were then exposed to a severe test: " Sol II " was the final result of all this work; it combines, in suitable proportion, the best characters of both its parents, the resistance to cold and the early maturity of " Sol ", and the normal method of germination and strength of haulm which are peculiar to " Extra Squarehead II ". As regards yield, " Sol II " is as superior to " Sol ", as to " Extra Squarehead II "

TABLE VI. — *Yield of grain per hectare produced by " Sol II " compared with the yield of the parent varieties, at Svalöf, during the period* 1913-1915.

Varieties	1913	1914	1915	Average	Comparative Index
" Sol II "	5 410 kg.	4 870 kg.	4 960 kg.	5 080	104.3
" Sol I "	5 340	4 530	4 740	4 870	100.0
" Extra Squarehead II "	5 500	4 330	4 740	4 860	99.8

Sol II " produces 210 kg. per ha., or 4.3 per cent more than " Sol I ". milar results were obtained in Östergotland (the Ullevi and Tolluby ations) and in Uppland (Ultuna Station). The averages obtained during le period 1914-1915 were: " Sol II " 4408 kg., " Sol I " 4 152 kg. per ha. l this case, " Sol II " produced 256 kg. per ha., or 6.1 per cent more than Sol I ".

As regards the average weight of 1 hectolitre of grain " Sol II " is superior to " Extra Squarehead ", but it is a little inferior to " Sol I ". Thus we have the following figures: " Sol I ", 79.0 kg , " Sol II ", 77.8 kg.; " Extra Squarehead ", 76.5 kg.

On the whole, it may be said that " Sol II " is superior to " Sol I " on account of its better germination, the strength of its straw and its high yield. It may be substituted for " Sol I " and can also be introduced into all the provinces of Gotland. Although the " Pansar " variety has already given excellent results when grown on a practical scale, the work of selection has gone on without interruption, with the object of isolating new, and still earlier, short-haulmed lines. Thus, in 1911, one plot was prepared for selection, and 45 of the best plants were chosen in 1912 to be the ancestors of the new lines. The characters of the descendents in 1913 were very diverse. There were great variations amongst the individuals of the various lines as regards precocity, length of straw, appearance of the ears and the average weight of grain per plant. Preference was given to 5 lines out of the whole number, and a series of comparative trials with the ordinary " Pansar " variety undertaken. The new lines, while in no wise inferior to " Pansar ", were distinguished by their larger yield, earlier ripening and the strength and length of their straw (which was shorter and thus more resistant to lodging). The productivity of these lines is shown in Table VII. The area of each experimental plot is 10 square metres.

TABLE VII. — *Comparative productivity of the various " Pansar " lines (grams of grain per plot).*

	Plot I	Plot II	Plot III
Ordinary " Pansar "	2 430 gr	2 800 gr	5 230 gr
Line I of " Pansar "	2 470	2 560	4 960
Line II of " Pansar "	2 290	2 870	5 100
Line III of " Pansar "	2 520	2 415	4 935
Line IV of " Pansar "	3 000	2 890	5 890
Line V of " Pansar "	2 650	2 950	5 660

Owing to these results, lines I, II and III were discarded, the work of selection and comparison being continued on a large scale with the two remaining lines, IV and V. In these cases also, " Pansar II " (line IV) was distinctly superior to the ordinary variety of " Pansar ".

	kg. of grain per ha.
" Ordinary Pansar "	5 830
Pansar II (Line IV)	6 030
Line V of " Pansar "	5 990

Other comparative trials are at present in progress at different Station and it is very probable that " Pansar II " will gradually be able to replac " Pansar I ". At Svalöf, in 1905, the writer crossed the native whe

(Landthvete) with the " Pudel " variety, and as a result of further selection, he obtained the variety " Thule I ". The latter, during the 5 years of comparative experiments at Svalöf produced, on an average, the same yield as " Pudel " but it was distinctly superior to the latter from the point of view of early ripening. The native type also always remained earlier than the hybrid; therefore it was considered advisable to continue the selection work from 1909-1911, with the object of increasing the precocity of the " Thule I " variety without any diminution of its productivity.

By this selection " Thule II " was obtained, a hybrid which fulfilled the required conditions, for its combines a good yield with the early ripening that makes this type of wheat particularly suited to the climatic conditions of Central Sweden.

TABLE IX. — *Comparative grain yields per hectare of Thule II and other Varieties of wheat gown at Svalöf from* 1911-1915.

Varieties	1911	1912	1913	1914	1915	Average	Comparative Index
"Sol" . . .	5 320 kg	4 090 kg	5 340 kg	4 530 kg	4 740 kg	4 800 kg	127.2
"Extra Squarehead II" . . .	5 280	3 950	5 500	4 330	4 740	4 760	126.1
"Thule II" . . .	—	4 320	5 380	3 930	4 560	4 550	121.7
"Renodlad Squarehead"	4 500	4 175	5 480	4 130	4 580	4 560	121.6
"Bore" . . .	4 210	4 150	5 330	4 260	4 670	4 530	120.6
"Thule I" . .	4 080	3 930	5 360	3 560	3 960	4 420	117.1
"Pudel" . . .	4 550	3 690	5 190	3 850	4 400	4 440	116.0
"Landthvete", native wheat) .	392	3 440	4 060	3 220	3 940	3 778	100.0

Thus " Thule II " produces on an average 6.8 per cent. (4 550 kg. per ha.) more than " Thule I " (4 280 kg.). In " Thule I ", Mr. Nilsson has succeeded in combining in a single type the productivity of " Pudel " with the cold resistance of the native wheat. On the other hand " Thule II " is somewhat more productive than " Pudel " without having forfeited any of its resistance to cold. " Thule II " is superior in yield not only to " Thule I ", but also to " Bore " and " Renodlad ", although it cannot rival the highly productive varieties, such as " Fylgia " and " Pansar ". Its grain weighs, per hectolitre, as much as that of " Landthvete " and more than Thule I ".

TABLE X. — *Weight of 1 hectolitre of " Thule II " grain, compared with the grain of other varieties. Results of experiments made at Svalöf during the period* 1912-1915.

Varieties	1912	1913	1914	1915	Average
"Thule II" . .	77.2 kg	78.9 kg	76.4 kg	78.3	77.7 kg
"Thule I" . .	74.1	78.2	75.9	76.2	76.9
"Pudel" . .	75.7	77.5	76.9	77.4	76.9
"Landthvete" .	78.1	79.3	76.6	76.5	77.6

" Thule II " is not only a more productive variety than " Thule I ", but is also distinguished by its greater resistance to lodging, due to its shorter and stronger straw. The trials made in Östergötland (Central Sweden), confirm the results already obtained at Svalöf.

TABLE XI. — *Yield of grain produced per hectare by " Thule II " compared with the yield of other types. Results of experiments made at the Östergotland Station during the period* 1912-1915.

Varieties	1914	1915	Average	Comparative Index
0 415 " Sol "	3 950 kg	4 860 kg	4 405 kg	120.4
0 290 " Extra Square-head II " .	4 160	4 550	4 365	119.0
0 825 " Thule II "	3 850	4 630	4 240	115.9
0 496 " Bore "	3 930	4 530	4 230	115.6
0 315 " Pudel "	3 730	4 620	4 175	114.1
0 820 " Thule I "	3 730	4 340	4 035	110.2
" Renodlad Squarehead " . . .	3 830	4 230	4 030	110.1
" Landthvete " (native wheat) .	3 850	3 480	3 660	100.0

The creation of " Thule II " is, without doubt, a great advance in the work of selecting types adapted to central Sweden. In no other type are the characters of precocity and resistance to cold and lodging found combined in better proportions with high yield and good quality of grain. Further improvement is moreover still possible. The writer is continuing to cross " Thule II " with the Swedish native wheat, in order to increase its specific cold resistance, and with the best types, (Fylgia ", " Pansar ") with the object of augmenting its productivity.

136 - **The Selection and Improvement of Indigo in Bihar.** - HOWARD ALBERT and HOWARD GABRIELLE, in *Agricultural Research Institute, Pusa, Bulletin* No. 67, pp. [illegible] 1 Plate. Calcutta 1916.

The two species of indigo cultivated in Bihar are known as Java and Sumatra indigo. The former type, which is preferred, is by no means uniform, for it consists of a number of forms differing: in habit (from tall erect to short, much-branched forms) — colour of the stems and foliage (greenish, intermediate and reddish) — size and shape of leaflets — time of flowering and root development. The occurrence in the mixture of forms resembling Natal indigo lends colour to the idea that Java indigo arose from a cross between the Natal plant and the species formerly cultivated in Java. At first sight, Java indigo appears to afford an ideal selection ground for the plant breeder. Before, however, considering the methods of improvement by selection adopted in Bihar, the following working conditions must be recapitulated :

1) Cross-pollination is the rule, and is normally brought about by the agency of insects (*Apis florea* and *Halictus gutturosus*).

2) The types composing the crop vary greatly in rapidity of growth and time of flowering. The range in time of flowering is correlated with the development of the root-system — the later kinds are deep-rooted.

3) The late, deep-rooted kinds contain the most indican. The

in selection, preference must be given to slow-growing late kinds with penetrating roots. Deep-rooted individuals are very apt to be affected by wilt, a disease which has been very prevalent of late years in the province of Bihar and has reduced the area under Java indigo by about $^4/_5$ th. The present selection methods are consequently diametrically opposed to those formerly obtaining, and aim at isolating and propagating early-flowering and vigorous individuals. This is done by two methods.

1) *Mass selection.* — The seed of a large number (200 or 300) of promising, early individuals is collected separately and sown in lines. Careful elimination of unsuitable plants is carried out before flowering begins and a second elimination, a few weeks after, serves to remove all late flowering individuals. The plants which remain supply the seed to be given out to the estates By this easy method, which can be carried out by any agriculturist, promising results have already been obtained.

2) *Individual selection.* — The only difference between this method and that just described is, that in the present case, the selection is started from one plant, instead of from a group. Experiments are being carried out on the Dholi estate, but they do not seem likely to yield very satisfactory results, for the individuals of a single type get into each others way much more than those constituting a mixture.

137 - **Selection Experiments on some Varieties of Raspberries in the United States.** — ANTHONY, R. D. and HEDRICK, U. P., in *New York Agricultural Experiment Station, Geneva, Bulletin* No. 417, pp. 75-85, Plates I - VIII. Geneva, N. Y., March, 1916.

The purple raspberry described for the first time by PECK in 1869 under the name of *Rubus neglectus* is a hybrid of the black-cap and red raspberry. The variability and inconstancy of the colour and appearance of the plant show its origin and nature, as do also the numerous experiments and cultural tests which have been carried out to prove its hybrid character. The popularity of this raspberry has been increasing rapidly and in some regions it has largely supplanted the black-caps, owing to its heavy production and its nearly complete immunity from anthracnose. At present, only 2 varieties of the purple raspberry are known, " Columbian " and " Shaffer " and these are but chance hybrid seedlings.

The success which they have had in so short a time shows the good results and the perfection that can be attained by means of judicious selection.

At the Geneva Agricultural Experiment station, some pure seedlings have been obtained; these give promise of new varieties much superior to any now under cultivation. The best mode of procedure, however, would seem to be to cross the most desirable reds and blacks, rather than to attempt inter-crossing among the purples, or to grow pure seedlings of any purple sorts. Among the red varieties the following were studied: Marlboro, June, Cuthbert, Herbert; and among the black; Cumberland, Gilborn, Palmer and Smith No. 1.

Marlboro. — This is an early variety with fruit of good size, but sometimes too soft for shipment and frequently lacking in high quality. The Marlboro appears to possess a factor for spinelessness, a few spineless plants appear-

ing in several of its crosses. From one of its seedlings has been isolated a variety, " June ", which is nearly spineless.

Herbert. — This variety lacks vigour and many of the plants died before bearing fruit. A few which survived, however, fruited and produced large berries of excellent quality. Hence it would seem that Herbert should be combined with some vigorous variety. Good results were secured by crossing it with June, (a variety descended from Marlboro, which has been described above).

Cumberland. — Some very interesting dwarfs appeared among the hybrid purples from Cumberland by June. The dwarf plants had nearly as many nodes as the normal ones but the internodes of the former were much shorter.

Smith No. 1. — An excellent variety with large, firm, black fruit of good quality. All the hybrids produced by crossing *Smith* with red varieties were purple, and the black plants which separated out in the F_2 generation had all the characters of the parent. Thus we must consider this variety as homozygous for the black colour factor.

The writer gives some interesting data respecting the inheritance of colour, the shape of the leaves, the presence of spines and the cane characters.

In the case of some, at least, of the above-mentioned characters, it is necessary to admit of the presence of many factors which greatly complicate the genealogical table of the hybrid, but which at the same time render possible an ever-increasing number of combinations. Some of these already seem superior to the purple varieties Columbian and Shaffer, hybrids now in high favour.

Wild varieties of *Rubus* imported from Asia and South America have also been used in the experiments in progess, with a view to combining the high yield and good quality of the cultivated varieties with the power of resistance to disease and unfavourable climatic conditions which belongs to the wild kinds.

138 - **The Improvement of the Walnut by Selection in California, United States.** - BATCHELOR, L. D., in *The Journal of Heredity*, Vol. VII, No. 2, pp. 61-65, Fig. 3-5. Washington, D. C., February, 1916.

During the last 10 years, the methods of propagating and cultivating the walnut in California have undergone a great revolution, for plantations of grafted trees are beginning to take the place of seedling groves. The best commercial varieties are used as scions. The nuts from many of these grafted varieties, however, fall considerably short of the commercial standard, in fact the produce of one of the heaviest bearing sorts, such as the " Chase ", " Prolific " and " El Monte " leaves much to be desired as regards quality, while, on the other hand, the " Placentia ", which bears the most ideal commercial nut, is not a heavy producing variety, especially in the northern walnut sections and is quite as susceptible to walnut blight (*Pseudomonas juglandis* Pierce) as the average seedling tree. Again, the " Eureka " variety which is nearly immune from walnut blight on account of its lateness in flowering is a very moderate yielding sort in the southern

sections. These varieties, together with a few others, are the commonest and the most cultivated. The wide range of climatic and soil conditions makes the eventual propagation of quite a large number of varieties inevitable. While the coast regions are bathed in fog nearly every morning during the growing season, the inland valleys experience an extremely dry climate with high maximum temperature. Hence it is necessary to create varieties which are especially adapted to the soil and climatic conditions obtaining in the different districts.

In many of the seedling groves, where the varieties have been propagated without any regard to the good qualities, or defects of the parents, there is a wide range of variability among the individual trees as regards habit, blowing season, character of foliage, resistance to disease, productivity and the shape of the nuts. It is not unusual to find the blooming season in a seedling grove extending over a period of from a month to six weeks. Further, some of the trees are frequently still bare when the nuts of early individuals are of the size of marbles. This variation makes it possible to select and propagate by grafting those kinds which bloom late, and are therefore, better able to resist the spring frosts. What has been said of the flowering season applies also to productivity which varies within very wide limits in the case of trees of the same age and size. Twenty trees in a given row of the same grove varied in productivity as follows. Number of pounds produced by each tree. 1-16-45-10-21-07-20-8 60-16-1-18-13-10-21-2-31-7-14.

The shape and the density of the foliage also vary considerably. There are broad-leaved varieties with dense foliage which protects the twigs and trunks from sun-scald. These are best adapted to the inland valleys, where the nuts and leaves often suffer from exposure to the sunshine. On the other hand, the narrow leaved sparsely foliated sorts appear to be less affected by the bacterial disease known as walnut blight, which is especially common in damp districts and on the coast.

Seedling trees differ very much as regards their susceptibility to blight. Among 105 trees in an orchard in Orange County, the percentage of diseased nuts ranged from 0 per cent to 95 per cent, while the average amounted to 47.1 per cent. It might therefore be possible, by careful selection, to isolate types which are nearly immune to this disease.

The nuts are as variable as the trees themselves, the shells vary from extremely rough unattractive specimens to smooth commercial types as the "Placetia", while the colour of the kernels ranges from dark brown to nearly white.

In the selection of varieties the walnut breeder in California is exceptionally favoured by the occurrence of a very large number of seedling trees (about 1 ¼ million). The first part of the work of selection will consist in isolating the types distinguished by productivity, fruit of good quality, disease resistance and late or early blossoming. In the second period of selection, which will naturally be very long, an attempt should be made to combine in one individual, by means of suitable crossings, the unit characters of sorts not in cultivation; by this means, in the course of time, ex-

cellent results could be obtained. Very little is known at present concerning the correlation of certain desirable, or undesirable, characters of walnut. Researches are now being made at the Citrus Experiment Station (Riverside Cal.) for the purpose of ascertaining these relationships.

139 - **Changes in the American Beet-Sugar Industry.** — *Commerce Reports*, No. 266, pp. 596. Washington, D. C., November 14, 1916.

Russia now occupies the chief position as the source of sugar-beet seeds for the United States. Before the war a very large proportion of these seeds came from Germany. A greatly increased total of purchases is shown by figures compiled for the nine months ended September 30, 1916, by the Bureau of Foreign and Domestic Commerce. Record-breaking imports foreshadow great activity in the sugar beet industry in this country.

For the nine months mentioned the imports of seed reached a total of 18 500 000 pounds, which is 1 000 000 pounds more than were imported during the complete calendar years 1913 and 1914, and nearly double those for the full year 1912.

In the fiscal year 1914 Germany supplied nearly 9 000 000 pounds out of a total of 10 250 000 pounds, the remainder coming chiefly from Austria-Hungary, Russia, and Holland. In the fiscal year 1916 Russia supplied 5 881 946 pounds out of a total of 9 042 490 pounds. Imports of beet seed into the United States for the calendar years 1911 to 1916 were as follows:

Years	Pounds	Years	Pounds
1911	11 025 533	1914	17 557 [illegible]
1912	9 854 803	1915	4 029 [illegible]
1913	17 644 721	1916 (9 months)	18 474 [illegible]

It is an interesting fact that exports of refined sugar in the first nine months of 1916 totalled 1 388 650 984 pounds, or nearly 50 per cent more than during the whole calendar year 1915, 3 1/3 times more than in 1914 and 26 times more than in 1913.

140 - **Cultural Trials of some Native and Foreign Wheats at Pharsalos, Thessaly.** - PAPAGEORGIOS, P., in *Georgikon Deltion Tis Vasilikis Georgikis Etaireias*, Year VIII No. 10-11, pp. 425-429, 3 fig. Athens 1916.

In 1915-1916, the Pharsalos Agronomical Station began a series of comparative trials with certain varieties of native (" Nteven " and " Arnauti ") and foreign (" Inversable de Vilmorin ", " Risciola bianca di Napoli ", Polish wheat *Triticum polonicum*). Among the last named " Inversable " has already been in cultivation in Thessaly for the last 4 years; the two others were now tried for the first time by the writer.

The characters which make *T. polonicum* especially valuable to Greece are: its resistance to spring droughts, so frequent and harmful in Greece — the firm attachment of the grains to the rachis, which enables the plant to withstand rough treatment without shedding the grain (the Greek wheats, whether owing to the wind, or during harvest and transport, lose on an average 10 % and sometimes as much as 20 %

of their grain) — its precocity, which enables it partially to avoid the action of the " scirocco " and heavy downpours which often spoil or damage the wheat harvest in Greece. A trial of one year is insufficient to permit of a judgment being formed as to whether Polish wheat will be capable of acclimatisation without loss of its useful characters : if it does prove to be so and if, at the same time, it yields a good crop, it will undoubtedly be adopted by farmers in many parts of Greece.

The variety " Risciola bianca di Napoli " has proved in comparison with local wheats and with *T. polonicum*, very poor in gluten, but on the other hand, very rich in starch. It has also been noticeable for its stout resistance to lodging as a result of the spring storms and in yield it has surpassed, by at least 10 %, all the other varieties tested.

Here, as elsewhere, " Inversable de Vilmorin " is prized for its resistance to lodging, thanks to its stout culm. It is already cultivated in Thessaly, over large areas, especially in low, fairly moist regions with fertile soil.

The Pharsalos Station is continuing the study of the above-mentioned wheats and intends to make further trials, in a permanent experimental field, with other varieties of wheat, barley and oats. Under the auspices of the Royal Agricultural Society of Greece, the Station will distribute for trial purposes, samples of seed obtained, to farmers in Thessaly, the Peloponnesus, etc.

1141 **The Chemical Composition of the Rices of Bihar and Orissa.** — SEN JATINDRA NATH, in *Agricultural Research Institute, Pusa, Bulletin* No. 62, 20 pp. 1 plate, Calcutta, 1919.

Analysis of 18 samples of paddy (unhusked rice) and polished rice from Bihar and Orissa, and, as an appendix, the analysis of 5 types of polished rice from Calcutta. The general results of the analysis of the first 18 samples are given below.

Average composition of 17 samples of paddy and polished rice

	Paddy	Polished rice
Weight of 1 litre of paddy in grms	583 g	—
Rice yielded per cent	—	72.4 %
Moisture	11.65 %	10.80 %
Grms per 100 grms air-dry rice :		
Ether extract	2.68 g	1.02 g
Albuminoids	8.50	8.14
Soluble carbohydrates	80.13	80.06
Woody fibre	0.80	0.22
Ash	1.82	0.80
Albuminoid nitrogen	1.36	1.28
Total nitrogen	1.38	1.30
Phosphoric Acid	0.80	0.40
Potash	0.41	0.32

From these results and by comparing them with those of previous authors the author has concluded that :

1) The composition of the rices of Bihar and Orissa is in the main similar to that of other rices analysed by previous workers. They approach, however, those of Burma more closely than they do the rest.

2) With an increase in the albuminoid content of husked rice there is a diminution in the quantity of soluble carbohydrates. On the other hand the low content of albuminoids is associated with increased amounts of soluble carbohydrates. When expressed as percentages of the dry matter, the sum of the albuminoids and soluble carbohydrates generally lies between 94 and 95.

3) The amount of phosphoric acid in a sample of husked rice is just a little less than half of the minerals present. The amount of potash is about half the quantity of phosphoric acid.

4) When rice undergoes polishing it loses much of the oil, or ether extract, and the minerals, besides some albuminoids. In the outer layers removed during this process the concentration of phosphoric acid is greater than that of potash, although there is relatively more of both these constituents in the bran than in the polished grain. The nitrogen is more uniformly distributed.

5) No relation can at present be traced between the chemical composition and the accepted culinary properties of the different rices.

6) As regards the dietetics of rice the greater acceptability of highly milled rice is attained at considerable loss of mineral substances. The use of these products requires greater attention to the mode of preparation of rice for the table and more careful consideration of the remainder of the diet than was necessary in the days of more primitive milling processes.

142 - **Fertiliser Trials with "Tetraphosphate" in Piedmont Rice Fields, Italy.** — MARCELLI and NOVELLI, in *Il Giornale di Risicoltura*, VIth Year, No. 21, pp. 321-327, Vercelli, Nov. 15, 1916.

Following the instructions of the Italian Ministry of Agriculture, Industry and Commerce, the writers have experimented on the effect of this new phosphatic product (1) in rice fields, that is to say, in extremely acid soils, very poor in lime.

The soil of the experimental field (Cascina Angossa, Vercelli Rice Cultivation Station), which has been under rice for the last 5 years, is fine particled sandy clay with deep permeable subsoil, rich in water, plentifully supplied with organic matter and, in view of preceding applications of fertiliser in considerable quantities, not devoid of mineral phosphates.

The preceding winter the whole rice field had received 3.5 quintal per hectare (2.79 cwt. per acre) of mineral superphosphate and a little farmyard manure. The soil was therefore fertile at the moment of commencing the trials. The "tetraphosphate" was compared with superphosphate and ground phosphorite on 3 lots of 100 sq. metres for each fertiliser, and a lot of 300 sq. m. serving as control. Towards the close of May, before

(1) See B. 1916, No. 1003.

flooding the rice field, the ground was ploughed to a depth of 18 cm. and the weeds completely buried. There were then applied to each lot 5 kg. of " tetraphosphate " or of phosphorite, and 9.3 kg. of superphosphate in order to equalise the fertilising units of the 3 lots.

TABLE I. — *Percentage Composition of the Phosphatic Fertilisers under Trial.*

Fertiliser	Moisture	Total phosphoric anhydride	Phosphoric anhydride soluble in citric acid	Phosphoric anhydride soluble in citrate	Division with KAHL sieve
Tetraphosphate	1.25 %	28.3 %	7.8 %	2.00 %	92.0 %
Ground phosphorite	3.00	27.5	10.5	2.70	91.5
Superphosphate	16.60	15.0	14.5	14.75	92.5

TABLE II. — *Yields per hectare* (1) *obtained in paddy fields with various phosphatic manures.*

Fertiliser tested	Phosphatic manure per hectare	Marketable grain (Paddy)	Residues of husking etc.	Straw
Tetraphosphate	500 kg.	6 330 kg.	270 kg.	2 930 kg.
Ground phosphorite	500	5 730	230	2 900
		5 900	270	3 100
Superphosphate	930	5 890	380	2 530

After spreading the manure the field was hoed and was not flooded before the 10th June. Thinning was carried out from the 15th to the 18th of June; sowing had taken place on the 15th April with selected paddy of the " Onsen " variety. When the plants had rooted, a top dressing was given on the 15th June of 200 kg. of calcium cyanamide per hectare and cultivation then proceeded in the usual way. The season was a fairly normal one. Harvesting was carried out on the 2nd and 3rd October. The composition of the fertilisers used and the results of the trials are given in the appended tables; they show that the tetraphosphate gave good results. However, the authors do not consider these results as sufficiently decisive and they propose continuing the experiments with the object of " distinguishing the possible basic or acid function of the various phosphatic fertilisers under trial from the specific function of each of them in relation to the lime or acid content of the soil " and in order to elucidate whether the presence of magnesium in the tetraphosphate (that employed contained 0.6 %) can have exerted a specific action.

(1) 100 kg. per hectare = 89.215 Cles per acre.

(*Id.*)

143 - **Rice Production in Peru** (1). — *Commerce Reports*, No. 273, p. 677. Washington, D. C., November 20, 1916.

In two coast Departments of Peru (Lambayeque and La Libertad) the cultivation of rice claims the attention of the greater part of the inhabitants. The land is fertile, there is an abundance of water, and the climate is favourable to the production of rice.

Being so favoured by natural conditions the rice planters have not yet begun to fertilize their land, as is done in other rice-growing countries, but take advantage of the extensive areas to let part of their ground lie fallow. About 60 000 acres in these two Departments are cultivated in rice, giving an average yield of about 1 500 pounds of rice per acre. The West Coast Leader in a recent issue states that this yield could probably be doubled if the land were thoroughly fertilized.

Little change is noted in the production of rice from year to year. New implements for cultivating and thrashing the rice are now coming in use, however, and the crop of 1915-16 shows a slight increase over that of 1914-15. It is estimated that the total production of rice in Peru, including the yield from Provinces in which rice is cultivated as only one of several crops, will reach 40 000 metric tons in 1915-16. The quality of Peruvian rice is said to be unexcelled, and it finds a market in other countries as well as at home. In 1913 Peru exported $ 380 686 worth of rice and imported $ 546 313 worth; in 1914 the exports amounted to $ 305 480 and the imports to $ 404 591.

144 - **Variety Tests of Maize.** — Hutchinson C. B., Evans A. R., Hackleman T. C. and Mc Donald E. M., in *University of Missouri Agricultural Experiment Station Bulletin*, pp. 56. Columbia, Missouri, July, 1916.

Variety tests of maize in Columbia and in various sections of the State in order to ascertain the best varieties suited to the various conditions and

TABLE I.

Variety	Length of ears ins.	Circumference of ears ins.	Maturation	Time for complete maturity in days	Height of plants in feet	
Boone County White	10.5-11	7.5-8	medium late	120-125	8.5	leafy
St. Charles White	9.5-10	7.25-7.5	late	125-130	8.5-9.5	leafy
Commercial White	10-10.5	7.5-7.75	late	125-130	9.0	highest yielder of corn
Johnson County White	10-10.5	7.5-7.75	medium late	120-125	—	like Boone County white
Silvermine	9-9.5	7.5-7.75	early	100-110	7.0	only fairly leafy
Reid's Yellow Dent	10-10.5	7-7.5	medium early	115-120	8.0	medium leafy
Leaming	10-10.5	7.5-7.75	medium late	120-125	8.0	—
St. Charles Yellow	10.5-11	7.25-7.75	late	125-130	—	very leafy
Cartner	9-9.5	7.25-7.5	very late	130-135	tall.	fairly leafy
Cob Pipe or Collier	7-10	9-11	very late	135-140	very tall.	—
Bloody Butcher	medium	cylindrical	medium late	120-125	8.5	leafy
Calico	9-11	cylindrical	medium late	120-125	8.5	leafy

(1) See International Institute of Agriculture, Bureau of Statistics, *International Year book of Agricultural Statistics*, 1913 and 1914, Rome, 1915.

TABLE II.

Order of varieties. Yields in bushels per acre

Soil and character	Commercial White	Reid's Yellow Dent	Learning	Boone County White	St. Charles Yellow	St. Charles White	N. of Trials
Black Prairies: Uplands; mellow silt loam over clay.	I 43.07	II 41.70	III 41.04	IV 40.96	V 40.11	VI 39.58	89
Level Prairies: Silt loam over clay.	I 41.18	III 38.04	VI 30.02	II 39.08	V 36.09	IV 37.40	67
Rolling Prairies: Coarse loams over gritty clay.	I 43.09	II 41.20	IV 40.73	V 30.27	III 41.17	VI 39.70	20
Gray Prairies: Silt Loam to sandy loam over clay or sandy clay.	I 30.06	IV 25.09	V 25.01	II 25.95	VI 24.39	III 25.71	30
Ozark Border; Gravelly loam or silt loam over silty clay	I 40.02	IV 30.26	VI 35.27	II 37.70	III 36.70	V 35.90	59
Ozark Uplands: Gravelly and stony loams over clay	I 30.53	V 27.13	VI 24.74	III 28.91	IV 28.48	II 29.81	37
Missouri bottom lands: Loams and sandy loams over loam.	I 51.02	V 46.21	IV 47.42	III 48.93	VI 44.18	II 50.18	13

soils of the State, and to disseminate the seed of the best varieties. The work done covers the period 1905-1914. The history and description of each variety is given together with an illustration. The following table gives a summary of the principal characters of the varieties (Table I).

The typical soils of Missouri are next discussed, and the yields obtained in the trials of the 6 leading varieties are given.

These data are condensed as follows (Table II).

These variety tests show that the leading varieties of white maize are Commercial White, Boone County White, and St. Charles White. The leading varieties of yellow corn are Reids' Yellow Dent, Learning, Cartner, and St. Charles Yellow.

145 - **Choice of Varieties and Seed Selection in Forage Crops.** — VIGGIANI D., in *Atti della Reale Accademia dei Georgofili di Firenze*, 103rd Year, No. 3, pp. 128-137. Florence, July 1916.

A summary of information and data obtained by the writer in the experimental fields of the "Vegni" Agricultural Institute (Arezzo, Italy) relating to spring, autumn and autumn-winter forage crops.

SPRING FORAGE CROPS. — The plants most commonly cultivated are crimson clover and vetches. In comparative trials in 1907-1908, the following varieties of crimson clover were examined: (*a*) early crimson ripening 5-6 days before the common clover; (*b*) late clover with white flowers ripening 7 days later; (*c*) extra late clover with red flowers ripening 10-12 days later. The yields of fresh forage were respectively 11.95 tons, 13.04 tons, 9.96 tons per acre, whereas the ordinary crimson clover in identical conditions scarcely gave 7.97 tons. These results show that it is profitable to grow successively maturing varieties on the same farm. In this way the drawback resulting from the use of clover cut too late, that is to say, when long, rough hairs are present on the calices of the flowers, is avoided. These form hard resistant masses in the intestine and are frequently capable of producing very serious inflammation. The Alexandrian clover, Moshàwi variety, widely cultivated in Egypt, has proved resistant in the course of trials, to a minimum temperature of — 4.5° C, and has shown itself to have become extremely well adapted to the climate of Tuscany, where it gives a yield of 11.95 tons per acre.

With regard to field vetches, the following varieties have been tested: *Vicia villosa*, 12.94 tons of fresh forage per acre — *V. narbonensis*, 23.9 tons per acre — *V. sativa* var. *alba*, 17.92 tons per acre — *V. macrocarpa*, 5.97 tons per acre — Common winter vetch (*V. sativa*), 12.74 tons per acre. As regards precocity, the Narbonne vetch (*V. narbonensis*) and the hairy vetch (*V. villosa*) are earlier than the remainder. It has also been remarked that the largest and heaviest seeds give the strongest plants.

SUMMER FORAGE CROPS. — The most commonly cultivated crop in this class is the small forage "Cinquantino" maize for which are employed the varieties cultivated for seed. The author, on the other hand, has compared the following varieties: Common yellow maize, 27.88 tons of fresh forage per acre. Caragua Horse-tooth maize, 39.83 tons per acre. The most profitable quantity of seed was 10.69 galls. per acre.

LATE AUTUMN FORAGE CROPS. — The commonest crop is rape, either cultivated alone or, more usually, along with oats, horse-beans, "Cinquantino" maize etc. The writer has compared the following varieties: Auvergne — White Norfolk — Red Norfolk — Val di Chiana — Pisa.

The "Auvergne" rape has: a piriform, flattened root; the neck very well developed and bluish red in colour; the foliage abundant.

The "white Norfolk" has a flattened spherical root, greenish white in colour, uniform, the neck thin, leaves large.

The "red Norfolk" has: a rounded root terminating in a pivot; the neck, very well developed, reddish; the chief veins also red.

The "Val di Chiana" has an irregularly cylindrical root very well developed, greenish white in colour.

The "Pisa" variety has a pivot shaped root and the neck pink.

The data collected have led to the conclusion that for earliness and ield "Val di Chiana" ranks first and "Pisa" second; then follow: "Norolk white", "Norfolk red", and "Auvergne". The difference between the talian and foreign varieties is so marked that there can be no hesitation n preferring the former. The writer has separated 7 varieties definitely listinct from those of the Val di Chiana variety; the study of the influence of size and colour of the seed has given the following results: the development of rape plants derived from big seeds is much superior to that of plants produced by average sized seeds, and still more superior to that of plants from small seed. No difference has been noticed between roots derived from dark seed and those derived from reddish seed.

146 - **History, Cultivation and Improvement of *Lolium perenne* at Svalöf, Sweden.** — WITTE HERNFRID, in *Sveriges Utsädesförenings Tidskrift*, Year XXVI, No. 5, pp. 195-205, 2 fig. Malmoe, 1916.

Lolium perenne (Perennial rye grass), a native of Europe, N. Africa and the temperate regions of Asia, has been also imported into N. America nd Australia. In Sweden, it grows wild as far as the 30th.° of latitude.

First cultivated in England towards the middle of the 17th. century, t first spread to Europe towards the end of the 18th. and beginning of the 9th. century. The exact date at which it was introduced into Scandiavia is unknown; some say in 1731, but it is only in the course of the last ew decades that it has become distributed as an important forage plant in he South of Sweden.

Lolium perenne is well suited by the moist climate of Great Britain nd Western Europe. In Sweden, it is especially adapted to localities here the early red Silesian clover is grown, the only leguminous plant hanks to its earliness) with which it can be grown.

However, in those regions of Scandinavia where the latter half of pring is too hot or dry, *Lolium perenne* is already completely dried up nd consequently of inferior nutritive value at the time of harvest, that is o say when the clover is in flower.

The data collected in Table I give an idea of the productivity of *Lolium perenne* compared with that of other forage grasses.

TABLE I. — *Yield per acre of certain forage grasses at Svalöf, during the period* 1910-1916.

	1st year		2nd year		Total	
	Fresh forage	Comparative index	Fresh forage	Comparative index	Fresh forage	Comparative index
	—	—	—	—	—	—
Lolium perenne . . .	114.54 cwt.	100.0	64.04	100.0	178.58	100.0
Swedish Timothy . .	96.38	84.1	83.47	130.3	179.85	100.7
Danish Cocksfoot .	121.15	105.8	117.40	183.3	238.55	133.6
Danish Tall Fescue .	155.56	135.8	122.50	191.3	278.06	155.7
French Rye Grass .	171.25	149.5	150.37	234.8	321.63	180.1
Danish Field-Brome .	165.99	144.9	—	—	—	—

The writer has carried out at Svalöf a series of comparative trials on various new varieties, such as "Sutton", "Evergreen", "Annual", "Dwarf perennial". These, generally speaking, are identical and do not differ from the common type.

There is, however, one exception in this respect: a variety from the coastal region of Norway (Faederen) which is characterised by its growth habit and precocity (it flowers some 10-12 days before the common varieties), but it is also more susceptible to the attack of *Puccinia coronata* var *Lolii*.

As regards yield, the Norwegian type remains superior to native varieties in wet and cold years, but its yield is affected by drought.

Lolium perenne is not at all uniform in its characters, all these latter varying within fairly wide limits; such for instance are: length of culms-stooling capacity — resistance to cold and rust — shape of leaf — earliness. Among individuals belonging to the same crop there may be a difference of a fortnight in the time of flowering.

The types of *Lolium* to be sown with early red clovers should show the following characters:

1) High yield of forage, both first cut and aftermath.
2) Good yield of seed.
3) Resistance to low temperatures.
4) Resistance to rust.
5) The flowering phase should coincide with that of red clover (thus late flowering types)

The "*Svalöfs Viktoria*" variety, selected and improved at Svalöf already largely fulfils these requirements. It is resistant to cold and rust has a well developed leaf system and very robust culms, a late flowering period and a good yield.

TABLE II. — *Yield per acre of the variety "Svalöfs Viktoria" compared with the common variety of Lolium perenne.*

	1st year				2nd year
Varieties	1st cut.	Aftermath	Total	Comparative index	
—	—	—	—	—	—
"Svalöfs Viktoria" .	131.37 cwt.	22.30 cwt.	152.69 cwt.	113.5	71.68 cwt.
Common type	111.27	23.26	134.53	100.0	54.16

As regards yield of forage, " Svalöfs Viktoria " thus yielded 13.5 % more the 1st year and 30 % more the 2nd year. But the most striking character is the delay in flowering (10 to 12 days after the common variety) so that at the time of cutting when the red clover is in flower, the plant is not yet dry, but green and luxuriant, even when the spring is a hot, dry one.

7 - **The Possibilities of Fodder Plants in South-Africa.** — POLE EVANS I. B., in *The Agricultural Journal of South Africa*, Vol. III, No. 17, pp. 113-135; Johannesburg, May 1916.

The little investigation work that has been done in the scientific study f the fodder plants of South Africa is sufficient to show that it would more an repay any outlay spent upon it. Not only could many of these lants be considerably improved by cultivation, but many of them are apidly disappearing.

Many of them are far better able to withstand the vagaries of the South frican climate than the majority of imported species. Although we now that some veld plants are eaten by cattle, others by sheep and another lass by horses, we have, comparatively speaking, no definite data as to hich plants are relished most by the different kinds of stock or which of hese plants are the most nutritious.

The distribution of some of the best known Fodder Plants in South frica is the following :

Panicum coloratum. — Said to be the sweetest of all the native grasses in British Bechuaand and very fattening.

Panicum laevifolium. — An annual sweet grass, one of our most valuable hay and pasture sses, fairly widely distributed in the Transvaal and also reported from the O. F. S. and tal.

Trifolium africanum. — A native clover very hardy and of excellent feeding value, equal- lucerne. Common in the Transvaal-Bethal, Pretoria, Lydenburg, Witwatersrand District, also in the O. F. S., Natal and Cape Province.

Anthephora pubescens. — Considered one of the best pasture grasses in parts of Bechuaand where it grows.

Chrysopogon serrulatus. — A grass much relished by stock in British Bechuanaland.

Trichoiaena rosea. — " Natal Red Top ". Annual grass. Widely distributed throughout Union.

Aristida obtusa and spp. — Tea grasses of the Kalahari regions, where they form the prinal fodder for stock ; rather coarse and wiry when it gets old.

Eragrostis superba. — Said to be a favourite and good fodder grass for cattle. Also other cies of *Eragrostis*.

Chloris virgata. — Old lands grass, sweet grass ; makes excellent hay. An annual.

Chloris gayana. — " Rhodes grass ". Perennial ; excellent pasture grass.

Ipomoea crassipes. — Reported from Sprigbok Flats as being much liked by stock. Anal by Government Chemist — general feeding value good.

Cabalva juncea. — From Springbok flats. Analysed by Government Chemist — feeding e good.

Merremia palmata. — From Pietersburg, said to be greedily eaten by ostriches and by le and sheep. Natives say that young stock fed on this do well and require no water. ners round Pietersburg who go in for catching wild ostriches say that to be successful with n they should be fed, for some time, entirely on this plant.

Pennisetum purpureum. — Elephant grass or Napier Fodder. — A native of Tropica Africa.

Pennisetum longistylum. — Kikuyu grass. — Also from tropical Africa; spreads rapidly and makes a mass of succulent herbage; eagerly eaten by stock.

Portulacaria afra. — The Spekboom. An indigenous plant found in the Eastern Karoo, one of the most drought resistant and at the same time nourishing plants to be found in the world.

Euphorbia cervicornis. — The Olifants Melkbos, a plant highly prized by the transport riders in Namaqualand and several other valuable fodder plants which would often repa attention and cultivation.

148 - **The "Water Pansy" or "Madagascar Pansy" (*Pistia aegyptiaca*) in th Island of Reunion: Composition and Uses.** — DE VILLÈLE A., in *Revue agricole d l'Ile de la Réunion*, Series II, Year IV, No. 8, pp. 205-308. St. Denis (Réunion), 1916

Towards 1865 an aquatic plant called "water pansy" or "Mada gascar pansy" (*Pistia aegyptiaca* Schleid = *P. Stratiotes* L.) was introduce

Production per hectare (2.47 acres) and chemical composition of Pistia aegyptiaca.

	Leaves	Roots	Total
Production of green matter per hectare. . . .	72 105 kg	22 895 kg	90 000 l
Constituents of green matter:			
Water	90.15 %	80 %	—
Organic matter	7.50	12.31	—
Mineral matter	2.35	7.69	—
Constituents of dry matter:			
Nitrogen	2.39 %	2.27 %	—
Constituents of ash:			
Phosphoric anhydride	3.63 %	1.81 %	—
Potash	15.09	9.10	—
Lime	4.69	1.61	—
Production of fertilising matter per hectare:			
Dry matter	7 123 kg	4 579 kg	11 702
Nitrogen	170.23	99.36	269 59
Phosphoric anhydride.	67.45	32.28	99.73
Potash	281.35	165.80	447.15
Lime	87.54	28.43	115.97
Nutritive constituents:			
Water	90.12 %	—	—
Ash	2.58	—	—
Fibre.	3.14	—	—
N. free extract	2.52	—	—
Fats	0.16	—	—
Crude protein	1.48	—	—

into Réunion and was allowed to spread in the " Etang de St. Paul " without being utilised. In view of its ultimate utilisation as a feed for livestock or as a manure, analyses were made at the Laboratory of the Mauritius Dept. of Agriculture which gave the data appended in the above table.

With regard to " water pansy " as a supplementary feed it must be used when the plant is younger and its fibre content smaller than that at the moment when the analyses were made.

The yield of manure afforded by *Pistia* represents a quantity of nitrogen and potash sufficient to be of decided value to the crops on which it is employed.

Wild Plants of Queensland (Australia) which can be Used for the Extraction of Textile Fibres and for the Manufacture of Paper. — *Queensland Agricultural Journal*, Vol. VI, Part, 4, pp. 235-238, 1 fig. Brisbane, October, 1916.

At the Agricultural Exhibition held at Bowen Park, Queensland, in 1916, Mr J. Campbell of Gossypium Park, Kamma, near Cairns, exhibited a collection of : textile fibre and their manufactured products ; baskets and paper made by the natives from the fibre of plants mostly found growing in Queensland in a wild state. The most remarkable of these products were the following :

A. — Textile fibres.

Jute (*Triumfetta* sp.) and Chinese Burr (*Urena* sp.). Herbaceous plants which can become the source of a most important industry. For the dyed jute he exhibited, Mr Campbell was offered £ 35 per ton, and it cost less than £ 20 to produce.

Rosella (*Hibiscus Sabdariffa*) fibre — The fruit of the rosella is worth from 2d. to 3d. per lb. for jam, and when the plants are rooted up they yield 7 per cent of fibre of which the present value is £ 40 per ton. Thus the fruit would be nearly all profit.

" *White Cotton* " (*Hibiscus*) fibre. — A wild tree which is very common in Queensland from Tweeds Head to Cape York. The fibre is worth £ 20 per ton and a man can prepare 1 cwt a day. Cord is made from the fibre.

" *QueenslandHemp* " (*Sida retusa*) fibre, pine apple and *Carica papaya* fibre.

B. — Paper Pulp.

Pulp made from Blady grass, or Lalang, (*Imperata arundinacea*) — In Queensland this plant grows wild and produces 4 tons to the acre on good land. Four tons will produce (according to its dryness) 1 $^1/_2$ to 2 tons of pulp and this is worth £ 8 per ton.

Triumfetta and *Urena* Pulp. — The whole plant can be converted into pulp, but if the fibre is taken, the balance can be made into pulp. Three tons will make 1 ton of pulp.

Sida retusa Pulp — This makes a very high class paper, suitable for bank notes and legal documents.

Pulp from Cane Tops. — makes excellent paper, especially ablotting-paper.

Pulp from Cane Top. — Makes excellent paper, especially blotting-paper.

Sugar Cane Megass Pulp. — As fuel megass is worth 5s. per ton, but for paper making it feches about 12s. 6d. to 15s. a ton delivered.

Banana Pulp. — After fruit-bearing, the whole plant can be manufactured into paper pulp. The paper produced is of very high quality. It takes 5 tons of banana stems and leaves to make 1 ton of pulp which is worth £ 10.

Pulp from pineapples, Pandanus sp. (which yields ¼ of its green weight of high-class pulp), *Hibiscus* sp., Bamboo.

150 - **Rubber Cultivation in Siam.** — HANSEN, C. C., in *Commerce Reports*, No. 279, p. 776. Washington, D. C., November 27, 1916.

Hitherto Siam has not acquired any distinction as a rubber-growing country, and during the last five years the export of this product through the port of Bangkok has been comparatively small. Such shipments are listed by the customs under the head of " Rubber and rubber substitutes ", the exports under this classification amounting to 142 304 pounds, valued at $ 18 533, for the fiscal year 1912; 229 240 pounds, value $ 32 548, for 1913; 207 025 pounds, value $ 33 431 for 1914, 125 764 pounds, value $ 15 533, for 1915; and 187 980 pounds, value $ 11 055 for 1916.

The only rubber plantation of any importance in southern Siam is located at Chantaboon and consists of 25 000 trees, planted about 6 years ago, of which 20 000 trees are now ready for tapping. Considerable quantities of rubber however, are said to come from northern Siam as the product of rubber-yielding trees in the jungle.

In the Siamese Malay States some attention has been given to rubber cultivation in the districts of Trang and Setul. Reliable information is not obtainable here, but it is said that the output of rubber has been insignificant so far in these Provinces.

151 - **Correlations Between Morphological Characters and the Saccharine Content of Sugar Beets.** — PRITCHARD, FREDERICK J., in *American Journal of Botany*, Vol. III, No. 7, pp. 361-376 + 8 fig. Lancaster, Pa., July 1916.

Cross sections of the sugar beet roots show a concentric appearance resembling the annual rings of a tree; wood zones alternate with zones of parenchyma. The former are the richer in sugar (average difference in favour of wood zones 2.6 per cent). As small roots usually have as many zones of wood as large roots, and relatively less parenchyma, they should contain the higher average percentage of sugar. A number of experiments and analyses have shown that this is the fact, and that the correlation between percentage of sugar and size of root is negative; the correlation index is — 0.258. The above-mentioned relationship and its nature are shown by numerous tables and graphs. The correlation between percentage and quantity of sugar in beet roots of equal weight is nearly perfect: 0.93 - 0.99. It is known that the correlation may go from — 1 to 1. There is, however, apparently no correlation in beet roots of miscellaneous weights.

TABLE I. — *Correlation between : Shape of Root and Crown and : Weight of Root, Quantity of Sugar per Root and Percentage of Sugar.*

	Average weight of root in Grams.	Average Quantity of sugar per root	Percentage of sucar in Beet
Shape of root :			
pyriform	443 g	78.28 ± 0.35 g	17.67 ± 0.02 %
conical	452	80.18 ± 0.44	17.75 ± 0.03
napiform	458	80.70 ± 0.85	17.63 ± 0.06
fusiform	510	88.24 ± 2.07	17.30 ± 0.12
cylindrical	590	99.88 ± 1.92	16.93 ± 0.14
Shape of Crown :			
flat	494	87.17 ± 0.55	17.63 ± 0.04
rounded	438	77.63 ± 0.30	17.74 ± 0.02
conical	433	74.83 ± 0.94	17.30 ± 0.06

TABLE II — *Correlations between Depth of Root Furrows, Growing Habit and Dimension of Leaves and : Weight of Root, Quantity of Sugar per Root and Percentage of Sugar in Beet.*

		Average weight of root	Average quantity of sugar per root	Percentage of sugar in beet
Depth of root furrows :				
medium		442 g	78.36 ± 0.43 g	17.71 ± 0.03 %
shallow		445	78.10 ± 0.48	17.55 ± 0.03
deep		468	82.91 ± 0.44	17.72 ± 0.03
Growing Habit of Foliage :				
erect		468	81.33 ± 0.67	17.37 ± 0.04
semi-erect		445	78.98 ± 0.29	17.74 ± 0.02
flat		482	85.03 ± 0.89	17.65 ± 0.04
Leaf dimension :				
Length	short	411	72.78 ± 0.62	17.69 ± 0.05
	medium	450	79.60 ± 0.30	17.70 ± 0.02
	long	497	87.05 ± 0.72	17.50 ± 0.05
Breadth	narrow	455	80.52 ± 1.41	17.70 ± 0.12
	medium	449	79.30 ± 0.26	17.68 ± 0.02
	wide	605	104.75 ± 2.28	17.31 ± 0.13

TABLE III — *Correlations between : Petiole Dimension, and Depth of Petiole Groove on the One Hand, and Weight of Root, Quantity of Sugar per Root and Percentage of Sugar in the Beet on the Other.*

	Average Weight of Root	Average Quantity of sugar per Root	Percentage of sugar in the Beet
Petiole dimensions :			
length . . short	439 g	77.55 g	17.67 %
length . . medium	445	79.13	17.80
length . . long	459	80.40	17.50
breadth . . narrow	420	74.02	17.61
breadth . . medium	452	80.20	17.75
breadth . . wide	525	91.50	17.43
Depth of petiole groove :			
shallow	419	74.12	17.67
medium	444	78.51	17.70
deep	479	84.61	17.66

A distinctly positive correlation (0.92) exists between the size (weight) of the root and the quantity of sugar it contains. The shape of the beet root also affects the sugar content. The roots may be conical, pyriform, napiform, fusiform and cylindrical, the latter are lowest in percentage, but highest in quantity of sugar.

Beets having flat crowns are heaviest and contain a slightly higher percentage of sugar than those possessing conical crowns which are usually smaller. The conical crown, therefore appears to be a detrimental character, as it is correlated with both low percentage and a small quantity of sugar. Table I gives data on this subject.

There is a positive correlation between the depth of the root-furrows and the sugar percentage.

As is shown by Table III. Three types of foliage are found in the beet : erect, semi-erect and flat. The flat, or rosette type, is correlated with the largest quantity of sugar per root, while the maximum percentage is found in the semi-erect type, the erect type being always inferior to the others. (see Table II). Positive correlation also exists between leaf dimension and root weight, and consequently between the size of the leaf and the quantity of sugar per root. The form and structure of the leaves and petioles are more or less in correlation with the sugar percentage. Beets having smooth leaves are richer in sugar than those with wrinkled, irregularly shaped foliage. Fine, pliable leaf texture is correlated with large roots, and therefore with a greater quantity of sugar.

On the other hand, the colour of the leaf and the type of leaf margin

TABLE IV. — *Correlations between Root Types and Sugar Percentages (number of roots with a given percentage of sugar).*

	Percentage of sugar																					No. of roots per type	Average sugar percentage per type
	13	13.5	14	14.5	15	15.5	16	16.5	17	17.5	18	18.5	19	19.5	20	20.5	21	21.5	22				
Type A . . . . . roots	1	1	1	2	3	5	9	12	12	6	11	5	6	4	2							80	17.07 %
Type B . . . . . roots				3	1	3	8	6	13	14	11	10	5	6	2	3			1			86	17.63
Type C . . . . . roots					2	4	3	9	11	11	12	13	7	8	4	1	2		1			88	17.93

TABLE V. — *Correlations between Root Types and Quantity of Sugar per Root (number of roots containing a given quantity of sugar).*

	Average of sugar																											No. of roots	Average quantity of sugar per root
	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150			
Type A . . . . . roots	1	1	1	2		5	7	8	7	9	10	7	2	5	5		3	1	1	1	1	1	1			1		80	74.68 g
Type B . . . . . roots			1			2	5	5	9	8	5	4	6	5	7	7	1	10	3	1		3		3		1		86	87.26
Type C . . . . . roots				3	4	2	1	2	5	7	4	9	11	7	7	6	7	3	3	2	3	2						88	85.51

undulate, sinuate or curly, are of no correlative importance. The dimension of the petiole has no correlation with the percentage of sugar in the root, the total sugar, however, increases with the size of the petioles which is specially marked in connection with the breadth. The increased depth of the groove on the upper surface of the petiole is also connected with a large quantity of sugar, as is shown by Table III.

By aid of the foregoing data, the writer distinguishes 3 types of sugar beets: A, B and C which have been formed by combining in A, characters correlated with relatively low sugar production, and in B and C, characters correlated with both a large quantity and a relatively high percentage of sugar.

Type A. crown conical, root furrows shallow.

Type B. crown flat or rounded, root furrows deep, leaf surface smooth, thin and pliable, petiole groove deep.

Type C. identical with B except in having a pyriform root (in B, the root is conical).

The writer divided 254 beetroots, according to their different characteristics, into 3 lots, 80 having the characters of type A, 86 those of type B and 88 those of type C. The correlations between these types and the sugar percentage are shown in Table IV, and the correlations between the types and the Quantity of sugar per root are given in Table V.

The number of individuals in each group is not large, but the distribution is fairly regular. B and C exceed A by several times the probable error, both in percentage and quantity of sugar per root. If the 2 other characters, wrinkled leaf surface and shallow petiole groove had been included in type A, the contrast between it and the other types might have been still greater.

It is possible, that if certain other characters, such as number of wood-rings, size, shape and number of bundles within the wood-ring, number of leaf-circles, (spiral turns), total number of leaves, and nature of veining had been included in the investigation, greater differences would have been exhibited between the types, and the work of selection would have been facilitated by the discovery of other clear, well-marked distinct correlations.

152 - **Manuring of Sugar Cane in Java: Comparative Resuls with Calcium Cyanamide and Sulphate of Ammonia.** — GEERTS, J. M., in *Mededeelingen van het Proefstation voor de Java Suiker-industrie, Archief voor de Suikerindustrie in Nederlandsch Indië*, Year XXIV, No. 44. Soerabaja, 1916.

The results of a series of 78 trials carried out from 1905 to 1914 in order to compare the action of calcium cyanamide and sulphate of ammonia on sugar cane in Java.

In 59 cases, sulphate of ammonia gave better results both as regard yield of cane and yield of sugar. The surplus given by sulphate of ammonia over calcium cyanamide is calculated at 2.5 % for the yield of cane and 2 % for that of sugar. The results have shown that in general, sulphate of ammonia gave better results than cyanamide both in light and heavy soils; however, one has the impression that cyanamide gives better results in light than in heavy soils.

The results of 16 trials show that partial application of cyanamide before planting is preferable to an exclusive application after planting; further, 13 other trials have shown the advantages of an application at 3 or 4 separate times, of which the first should be before planting; when it is given at least one week before planting and the subsequent applications are not allowed to come in contact with the plants, the cyanamide is transformed before reaching the rootlets and there is scarcely any danger of an injurious action. Partial substitution of sulphate of ammonia by cyanamide is more certain than complete substitution, but the cyanamide should always be applied before the sulphate of ammonia.

Finally, cyanamide has no influence on the maturation of the cane.

The writer recommends further trials on the same subject.

153 - **Experiments on the Drying of Tobacco in Java.** — DE VRIES, O., in *Mededeelingen van het Proefstation voor Vorstenlandsche Tabak*, No. XXV, Semarang, 1916.

The writer has experimented with various methods of drying tobacco, in the drying sheds in common use in Java, and in a little warmed and ventilated, brick building, where temperature and humidity were under continual control.

Two phases are distinguished in the drying process: the 1st is marked by the transition of the green colour of the leaves to brown, lasting 7 to 10 days; the 2nd is characterised chiefly by the drying of the midrib and by the completion of the drying of the brown leaves. During the 1st phase, the tobacco is very sensitive to slight changes of temperature. The writer experimented between 26 and 30° C. and found that a difference of 2 to 3 degrees had considerable influence on the drying. The relative humidity of the atmosphere has also some influence. During this phase ventilation hardly affects the drying process. Rapid drying gives a better quality tobacco, with thin pliable leaf and generally lighter colour.

Among the drawbacks of rapid drying are the fact that the tobacco becomes more hygroscopic and is more liable to lesions during piling preparation to fermentation. But by careful handling of the stacks during packing of the leaves these injuries may be avoided. On the other hand, slow drying more easily gives rise to rotting of the tobacco or at any rate to the formation of mould which spoils the leaves.

During the 2nd stage, the greater or less speed of drying made little difference, though leaves dried rapidly are lighter in colour. By speeding up drying by means of heating the sheds, the 2nd phase may be shortened by 4 to 5 days.

Generally speaking, rapid drying gives certain advantages, and the writer recommends further experiment.

The experiments on artificial drying have shown this method to have many advantages for the quality of the finished product. Tobaccos obtained in this way were submitted to European experts and they were unanimous in proclaiming the superior quality of the tobacco treated in this way.

Hitherto, drying during the 1st phase has had hardly any attention from planters, but the writer recommends more care during this stage.

He already thinks to have obtained an improvement by regulating the distances between the poles to which the strings are attached which support the leaves in the sheds.

154 - **Results of the Inter-Ministerial Conference in 1915 on the Production and Improvement of Medicinal Plants in Russia.** — Сапыперовъ Ф. (SAZYPEROV, F.), in *Трудыі Бюро по прикладной Ботаникѣ* (*Bulletin of Applied Botany*), Year IX, № 7 (92), pp. 385-387. Petrograd, July 1916.

This Conference (1), summoned by the Department of Agriculture in order to discuss the question of rendering the Russian Chemical Industry independent of foreign imports, was supported not only by the representatives of the various Government Departments but also by the representatives of science and of the most important commercial houses dealing with medicinal plants and their seeds. The following is a summary of the recommendations and decisions adopted:

A. — CULTIVATION AND GATHERING OF WILD MEDICINAL PLANTS.

1) It is desirable: *a*) to intensify the collection of the following plants and also the methods of preparation:

Adonis vernalis L. = False Hellebore

Tussilago Farfara L. = Coltsfoot (Leaves).

Valeriana officinalis = True Valerian.

b) to study the properties of valerian, gathered both in high and low situations.

2) It is recommended that the following plants should be gathered and the methods of preparation improved:

Achillea Millefolium L. = Yarrow (leaves and seeds).

Acorus Calamus L. = Sweet flag (rhizome), for export.

Arctostaphylos Uva-ursi Spreng. = Bear-berry (leaves).

Cannabis sativa L. var. *indica* = Indian Hemp (seeds).

Centaurea Jacea L. = Centaury (herb).

Colchicum autumnale L. = Meadow saffron (seeds).

Lactuca virosa L. = Field Lettuce (seeds).

Matricaria Chamomilla L. = Wild Camomile (flowers).

Orchis Morio L. = Green-veined Orchis (tubers).

Secale cornutum. = Ergot of Rye

Veratrum album L. (rhizome).

Verbascum Thapsus L. = Aaron's rod (flowers).

3) Methods of collecting and drying the following plants should be improved:

Brassica nigra Koch. = Black mustard (seeds).

Aspidium Filix mas Sw. = Male fern (rhizome).

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(1) See *B.* 1916, No. 651. — See also 2 publications of the Dept. of Agriculture: 1) МОНТЕВЕРДЕ Н. (MONTEVERDE N.) *Поройонный обзоръ лекарственныхъ растеній въ Европейской Россіи, Кавказа и Туркестана.* (Regional review of the medicinal plants in European Russia, the Caucasus and Turkestan) Juriev, 1915 — 2) КОМАРОВЪ В. (KOMAROV, V.) *Сборъ, сушка и разведеніе лекарственныхъ растеній въ Россіи* (Cultivation, harvesting and drying of medicinal plants in Russia), 1915. (*Ed.*)

Hyoscyamus niger L. = Henbane (leaves).
Laurus nobilis L. = Laurel.
Lycopodium clavatum L. = Common Club-moss (spores).
Melilotus officinalis Lam. = Melilot (herb).
Menyanthes trifolium L. = Bog-bean (leaves).
Taraxacum officinale Weber. = Dandelion (leaves and roots).

4) For the following plants, the quantities already gathered must suffice:

Artemisia Absinthium L. = Wormwood (herb).
Asperula odorata L. = Woodruff.
Cetraria islandica L. = Iceland Lichen.
Conium maculatum L. = Hemlock.
Ephedra vulgaris Rich. (= *E. distachya* L.) = herb.
Fragaria vesca L. = Strawberry.
Juniperus communis L. = Juniper.
Nigella sativa L.
Polyporus officinalis Fries (= *P. Laricis* Duby).
Punica granatum L. = Pomegranate bark.
Rhamnus Frangula L. = Berry-bearing Alder.
Tilia sp. = Lime.
Vaccinium Myrtillus L. = Whortleberry.
Veratrum album L. = Sabadilla.

5) The following plants, not yet included in the Russian pharmacopeia, should be studied:

Matricaria discoidea D. C. = Rayless Camomile.
Polygonum Hydropiper L. = Water Pepper.
Verbascum thapsiforme = Mullein.

6) Attention should be paid to the collection of gum from species of *Ferula* (*F. Asafoetida* L., *F. galbaniflua* Boiss.) and the gathering of lilies of the valley (*Convallaria majalis*) for sale in the fresh state is also recommended.

B. — Cultivated Medicinal Plants

1) The cultivation of the following plants is regarded as necessary:

Aconitum Napellus L. = Monkshood.
Althaea officinalis L. = Marsh Mallow.
Anthemis nobilis L. = Camomile.
Archangelica officinalis Hoffm. = Gard. Angelica.
Arnica montana L. = Mountain Arnica.
Atropa Belladonna L. = Deadly Nightshade.
Carum Carvi L. = Carraway.
Cochlearia officinalis L. = Scurvy Grass.
Chrysanthemum cinerariaefolium Vis. = Dalmatian Pyrethrum.
Digitalis purpurea L. = Foxglove.
Eucalyptus spp.
Erythraaea Centaurium Pers. = Centaury.
Foeniculum officinale All. = Fennel.
Gentiana lutea L. = Gentian.

Glycyrrhiza uralensis Fisch. = Liquorice.
Hydrastis canadensis L. = Golden Seal.
Iris germanica L.
Iris florentina L.
Laurus nobilis L. = Laurel.
Lavandula officinalis Chaix = Lavender.
Matricaria Chamomilla L. = Wild Camomile.
Mentha piperita L. = Peppermint.
Mentha crispa L. = Spearmint.
Pimpinella Anisum L. = Burnet Saxifrage.
Rheum palmatum L. = Rhubarb.
Ricinus communis L. = Castor-oil Plant.
Rosa spp.
Rosmarinus officinalis L. = Rosemary.
Saponaria officinalis L. = Soapwort.
Sinapis juncea L. (= *Brassica juncea* Coss.).
Thymus vulgaris L. = Thyme.
Trigonella Foenum graecum L. = Fenugreek.
Valeriana officinalis L. = True Valerian.
Verbascum thapsiforme Schrad. = Mullein.
Verbascum phlomoides L. = Mullein.

2) The cultivation for medicinal purposes is advocated of:
Artemisia Dracunculus L. = Wormwood.
Bidens tripartita L. = Trifid Bur-Marigold.
Capsicum annuum L. = Cayenne.
Coriandrum sativum L. = Coriander.
Crocus sativus L. = Crocus.
Hyoscyamus niger L. = Henbane.
Levisticum officinale Koch. = Lovage.
Majorana hortensis Moench. (= *Origanum Majorana* L).
Paeonia officinalis L. = Peony.
Papaver somniferum L. = White. or gard. Poppy.
Salvia officinalis L. = Sage.

3) The Commission considers it necessary to carry out experiments with the following plants:
Colchicum autumnale and neighbouring species.
Convallaria majalis = Lily of the Valley (to determine the propertie this species acquires under cultivation).
Digitalis sp. = Various species of foxglove.
Polygala Senega T. = Senega.
Rhamnus Purshiana D. C. = Cascara sagrada or sacred bark.

155 - **"Jaboticaba de cipó" (*Chondodendron platyphyllum*) a Wild Brazilia Fructiferous and Medicinal Plant.** — PECKOLT GUSTAVE, in *Chacaras e Quintas* Vol. 14, No. 5. pp. 821-823. São Paulo, Nov. 15, 1916.

The writer has identified the plant called in Brazil "Jaboticaba d cipo", "Abutua legitima", "Parreira brava", "Parreira do matto" "Uva do matto", as *Chondodendron platyphyllum*. It is a menisperm

sarmentous, climbing, monoecious plant, very common around Rio de Janeiro, wild in the States of Rio de Janeiro, Espirito Santo et Minas where it is particularly fond of the shade and dampness of the woods. The fruits form large clusters with black or purplish-red grapes, from 20 to 25 mms. in length and about 17 mms. in cross section, containing a large seed. The pulp has an acid sweet taste resembling that of the grape. In 100 grams of fresh pulp, the writer has found :

Water	84.583 gr.
Fats	0.308
Colouring matter	2.273
Glucose	3.430
Tartaric acid	0.357
Malic acid, pectine, gums etc.	4.331
Albuminoids	1.013
Ash	1.480

In the State of Rio de Janeiro, this plant flowers in January and gives ripe fruit from June to August; in that of Minas, it flowers in April and ripens in September.

The fruits keep for a long time. They are eaten raw and various cakes are prepared from them : their juice, fermented, and with the addition of 3 to 4 % sugar, makes a good wine. A dark red colouring matter is also extracted.

The root of " Jaboticaba " has long been used as a popular medicine in Brazil, serving as a tonic, diuretic and febrifuge. These properties have been confirmed by various European scientists (WIGGERS, 1838; VITALI, 1857), but the root is still very little employed in official medicine.

346 - **Experiments with New Grape Stocks at the Montpellier National School of Agriculture, France.** — RAVAZ, L, , in *Le Progrès agricole et viticole*, 33rd Year, No. 45, pp. 437-442. Montepellier, Nov. 5, 1916.

With the object of experimenting with new stocks the writer, in 1913, tablished a new experimental field at the Montpellier Agricultural hool. The soil contained 34 % of lime, was fairly homogenous and ther on the clayey side.

ilorosis occurs in spring in varying degrees among the different varieties it is usually without importance for " Riparia ".

The results are given in the appended Tables which give 3 kinds of formation :

1) the average production per stock ; 2) the weight of the shoots, so per stock, which gives a measure of the vigour of the graft ; 3) the itio $\frac{F}{V}$, F representing production and V the weight of the shoots. his ratio also serves as a measure of the fertility of the subject ; formation fruit etc. The vines under observation were 2 year-old grafts.

REMARKS. — *Riparia Gloire* and *Rupestris du Lot* serve as standards comparison. The former remained low.

New Grape Stocks Tested at the Montpellier National School of Agriculture

I. SCION : ARAMON.

Nos of the rows	Stocks	F Average weight of grapes per stock	V Average weight of shoots per stock	$\frac{F}{V}$
1	Riparia Gloire	916 g	299 g	3.158
2	Riparia Gloire	700	325	2.153
3	Rupestris du Lot	1 283	683	1.878
4	Rupestris du Lot	2 775	875	3.171
5	Monticola	450	358	1.256
6	Cordifolia	1 958	616	3.191
7	Rubra	0	0	0
8	Candicans	2 350	370	6.351
9	Berlandieri (École de Montpellier)	2 200	491	4.480
10	Berlandieri RICHTER	2 820	630	4.476
11	Cinerea	1 150	290	3.965
12	3309 (Riparia-Rupestris)	1 825	650	2.807
13	3306 (Riparia-Rupestris)	3 896	850	4.583
14	Rubra-Rupestris 5-2 RAVAZ	1 566	416	3.764
15	216-3 (Candicans Riparia-Rupestris)	3 120	600	5.200
16	106-8 (Cordifolia Riparia-Rupestris)	100	233	4.291
17	18 804 (Riparia-Monticola)	2 216	700	3.165
18	1 R. (Riparia-Monticola)	1 350	190	7.105
19	2 R. (Riparia-Monticola)	1 100	316	3.481
20	Cordifolia-Rupestris No. 1 de GRASSET	775	425	1.823
21	Rupestris-Rubra 5-1 RAVAZ	2 260	460	4.913
22	333 (Cabernet Berlandieri)	1 750	600	2.916
23	41 B (Chasselas Berlandieri)	2 850	566	5.035
24	Rupestris du Lot renversé	833	180	4.627

Rupestris du Lot, in row 3, was planted in the usual manner ; in row 4, the plants were placed on flat stones in order to force the roots to take a horizontal direction. The result of this was an important increase in growth and fructification.

Vitis Monticola is always remarkable for its high resistance to chlorosis ; it is incontestably superior to *V. Berlandieri* : unfortunately it lacks a little vigour and seems especially sensitive to drought.

V. Cordifolia leaves something to be desired on account of chlorosis.

V. Rubra died of chlorosis.

V. Candicans did not do very well either.

New Stocks tested at the Montpellier National School of Agriculture
II. Scion : ARAMON.

Nos of the rows	Stocks	F Average weight of grapes per stock	F' Average weight of shoots per stock	F / F'
1	33 E. M. (Riparia Berlandieri)	1 720 g	533 g	3.227
2	34 E. M. (Riparia Berlandieri)	1 550	390	3.974
3	420 A. (Berlandieri Riparia)	1 320	516	2.558
4	161-49 (Berlandieri Riparia)	1 075	387	2.777
5	(Rupestris Berlandieri École) P. D. 5	1 800	666	2.727
6	Riparia Rupestris 2-1 RAVAZ	1 550	525	2.952
7	Rubra Rupestris 5-3 RAVAZ	1 350	575	2.347
8	Rubra Riparia 5-4 RAVAZ	0	200	0
9	Berlandieri Rupestris 1-3	1 533	583	2.646
10	17-37 (Berlandieri Rupestris)	1 657	700	2.367
11	44 RICHTER (Berlandieri Rupestris)	3 550	860	4.127
12	99 » (idem)	2 733	800	3.416
13	60 » (idem)	1 375	587	2.342
14	110 » (idem)	2 990	810	3.580
15	31 » (idem)	3 500	720	4.861
16	57 » (idem)	1 958	791	2.475
17	141-2 (Cord. Rup. Jard. × Rip. glabre)	3 558	975	3.640
18	4 449 (144 Cordifolia Rupestris × Rupestris)	3 066	925	3.310
19	583-38 (Rip. Rup. No. 3 JÆGER × 150-4)	500	162	3.080
20	Rupestris du Lot	1 937	912	2.120
21	93-5 (coudé)	920	675	1.360
22	93-5	1 360	760	1.770
23	1 202	1 125	600	1.870
24	Aramon Rupestris GANZIN No. 9	916	766	1.190

V. Berlandieri is quite pretty and fertile, especially the RICHTER *Berlandieri*. This latter also proved to be more vigorous than other varieties of the same species.

Cinerea is very week.

3306 and 3309 Couderc are always worthy of note. In this soil as n others belonging to the School, the first surpasses the second, probably ecause its root system develops better.

Row 14 is occupied by a cross between *V. Rupestris* and *V. Rubra* hich the writer obtained some years ago. It has small interest for this ype of soil.

New Stocks tested at the Montpellier National Shool of Agriculture.

III. — Scion : CINSAUT.

Nos of the rows	Stocks	F Average weight of grapes per stocks	V Average weight of shoots per stock	F / V
1	3306	600 gr	783 gr	0.779
2	3309	1 041	666	1.363
3	101-14	250	516	0.048
4	Champin	950	541	1.772
5	125-1	1 766	750	2.354
6	106-8	266	550	0.483
7	107-11	1 291	516	2.501
8	216-3	850	833	1.020
9	227-1 CASTEL	1 750	858	2.039
10	215-1	1 650	675	2.444
11	Arizonica	1 400	450	3.111
12	Cordifolia	1 300	666	1.951
13	V. Rubra	1 208	490	2.465
14	143-14-6	1 700	516	3.291
15	437-3-4	1 433	710	2.018
16	366	2 116	841	2.516
17	Salas	1 266	600	2.11
18	Berlandieri RICHTER	3 725	590	6.313
19	Berlandieri Rupestris No. 1	1 750	866	2.020
20	439-69	566	866	0.653
	583-7	3 066	666	4.603
21	H. N. 18-49	600	740	0.810
22	H. N.	766	450	1.702
23	H. N. 19-52	1 266	441	2.870
24	6266	1 291	1 266	1.019

216-3 is a CASTEL hybrid : *Solonis* by *Rupestris du Lot*. Interesting

106-8 is very weak here.

18 804 is a hybrid obtained by CASTEL from *V. Riparia* and an impur *V. Monticola*. The writer regards it as superior to *Riparia-Rupestris* i its resistance to chlorosis ; he has been calling attention to its qualitie for a long time past.

1 R. and 2 R. are pure *Riparia Monticolas* ; their chief fault lies i their lack of vigour, which hardly exceeds that of *Riparia*. On the othe

hand, they are much superior to *Riparia Berlandieri* varieties in their resistance to chlorosis.

F. GRASSET's Cordifolia suffers from chlorosis.

Rupestris Rubra 5-1 was obtained by the author. Normally, it is very vigorous but it is not suited by chalk. The hybrids of this group should be studied in other soils.

333 and 41 B are well known *Vinifera Berlandieri* varieties. In this experimental field they are very equal in value; any slight difference that may exist being in favour of 333. These 2 varieties suffered somewhat from drought.

The *Riparia Berlandieri* varieties 33-34, 420 A, 161-49 COUDERC show the same resistance to drought here as they have done elsewhere. Greater vigour would be an advantage.

The *Rupestris-Berlandieri* varieties are much stronger and also possess high resistance to chlorosis. Some of of them will undoubtedly find a place in French vineyards.

The production of the French-American hybrids: 93-5; 1202; GANZIN No. 9, leaves room for improvement. This is partly in consequence of their great vigour, as some of them had their shoots broken by the wind.

The vineyard grafted with Cinsaut is older, the nature of the stock explains the feeble production of each shoot. 3306 is still more vigorous than 3309. If the quantity of fruit is less, it is because, on account of its position, it suffered more than its neighbour from the visits of passers-by. 101-14 is very weak.

Champin is vigorous, but unfortunately incapable of practical use; 125-1 is not suited to this type of soil which is too rich in lime; 106,8 is still very weak. Rows 8,9 and 10 are occupied by hybrids of the same group: 227.1 seems superior to the others. *Berlandieri Rupestris* No. 1 from the Montpellier Schoold is equally interesting.

CONCLUSIONS. - In the clayey-lime soil under consideration, the following varieties are worthy of note for their vigour and productivity:

Rupestris du Lot; 3306; 18-804; *Rupestris Berlandieri* and especially Nos. 99 and 110, RICHTER; 41 B and 333; 93-5, 1202 COUDERC, and *dramen* GANZIN No 9; 216 and 227-1 CASTEL. The highest yields were given by B. RICHTER: 227-1 Castel; *Rupestris du Lot* on stone; 3306; 216-3; 18 804; 41-B; 99 and 110 R. etc. These results only refer to the first year of production; it is possible that in subsequent years they may be different. However they may well be borne in mind without there being much chance of serious errors occurring.

57 - **Black Poplars.** — HENRY, A. in *Transactions of the Royal Scottish Arboricultural Society*, Vol. XXX, Part 1, pp. 14-27, Fig. 1-12. Edinburgh, January 1916.

A study of the numerous types (species, varieties, sports and hybrids) of the European black poplar (*Populus nigra* L.), and of the north American poplar (*P. deltoidea* Marshall).

The glabrous kind of the European black poplar (*P. nigra* var. *typica*) strictly limited to southern and south-eastern Europe; it is rarely

cultivated in Great Britain. Its fastigiate form (*P. nigra* var. *italica*) which is the characteristic Lombardy poplar, is probably a sport. As is well-known, the pyramidal, or Lombardy poplar is nearly always of the male sex, the only female Lombardy poplar with truly fastigiate habit known to the writer is in Kew Gardens. The rare female poplars reported as occurring in Germany from time to time are due to hybridisation.

The other principal variety, *P. nigra* var. *betulifolia*, is distinguished by the dense, short pubescence on its twigs; it is apparently wild in southern England and throughout France. *Populus plantierensis* is the fastigiate form of the pubescent black poplar.

The north American black poplar differs from the European species in the shape of its leaves, and the presence of cilia on the margin, and glands on the base of the leaf blade in front, as well as in various floral characters. The writer distinguishes 3 geographical varieties: *P. deltoidea* var. *monilifera* Henry, from the north-east of North America (1), *P. deltoidea* var. *occidentalis*, Rydberg, from the prairie region; *P. deltoidea* var. *missouriensis* Henry, from the south-east region.

The black poplars which are cultivated for timber in France and Belgium, and also in England, are almost invariably of hybrid origin, being crosses between the above-mentioned forms of the European and American black poplar. They have been propagated on account of their exceptional vigour. The chief are: *Populus angulata* Aiton (*P. deltoidea* var. *missouriensis* × *P. nigra* var. *typica*); *Populus serotina* Hartig (*P. nigra* var *typica* × *P. deltoidea* var. *monilifera*); *Populus regenerata* Schneider (*id.*); *Populus Eugenei* Simon-Louis (*id.*); *Populus marilandica* Bosc (*id.*), *Populus Henryana* Dode, *Populus robusta* Schneider, *Populus Lloydii* Henry of obscure origin. The writer discusses the origin of all these hybrids their characteristics and botanical characters, He also gives some interesting information respecting their dimensions, and describes a wonderful tree of *P. Eugenei* which appears still to be growing rapidly, and measured when 81 years old, 150 ft in height and 25 ft in girth at 5 ft above the ground.

Until lately, all the hybrid poplars in cultivation were the result of accidental crossing, but the artificial production of fast-growing hybrids is now being attempted. The most interesting, so far obtained by Prof Henry is *P. generosa* (*P. angulata* Ait. × *P. trichocarpa* Forr. and Gray, the balsam poplar of the Pacific Coast) (2).

At the end of the paper is given a key to the Black Poplars, reproduced from the writers' work "The *Trees of Great Britain and Ireland*" (Vol VII, 1913).

(1) Its hybrids are usually confused with the varieties *P. Monilifera* Ait. and *P. Canadensis* Mchx. (*Ed.*)

(2) See *B.* 1915, No. 31. (*Ed.*)

158 - **The Restoration of Forests Devastated by the Operations of War.** — JOLYET A., Professor at the Ecole Nationale des Eaux et Fôrets), in *La Nature*, No. 2256, pp. 401-406, figs. 1-7. Paris, Dec. 23, 1916.

The North East of France is a well wooded region and it is natural that numerous forests should have suffered as a result of the operations of war. However, though the damage incurred may have been great, it does not follow that the forests must necessarily be destroyed.

A forest is not merely formed by the sum of the plants living therein but also by the forest soil, or primitive soil modified by the existence of the forest, and by the sum of the plant and animal life there developed. The "état boisé" (wooded state) so produced represents a valuable capital and it would be a serious mistake not to utilise it as soon as possible, for this state or condition, though surviving the destruction of the forest population, does not last for ever.

There are two methods of regenerating a forest in these conditions: one natural and the other artificial. The former is not profitable, being too long, whereas the interest of the owner lies in obtaining commercial timber from his forest as soon as possible.

The first point then to establish in restoring a forest damaged by war is whether the injured trees are definitely broken or merely bruised. In the first case they must be cut down level with the ground and, provided the species is a deciduous one and not too old, new shoots will then emerge from the stump. On the other hand, if the tree is a conifer, no shoots will be formed, but by cutting down the tree the danger of encouraging insect parasites will be avoided. In the second case also, felling is almost always advisable, for a mutilated tree is not likely to produce healthy wood.

As a result of the felling, gaps of greater or less extent will occur. These it will be necessary to fill up by means of appropriate species: *a*) encouraging the natural reconstruction of the forest with wild species, or at any rate not impeding the same by an excessive amount of cover; *b*) capable of furnishing within a short period good marketable timber the sale of which will enable the proprietor to put back the forest in its original state.

Next, the 2 following cases must be considered:

1) *Gaps of large extent.* — When the removal of damaged plants leaves a very big gap, it is advisable to plant not merely a temporary but also a robust species with light shade in order to allow the reconstitution of the original species (oak, hornbeam, maple, ash, fir, etc.). The majority of pines fulfil these requirements, the Austrian pine is particularly adapted to a thin chalk soil; in sandy soil, on the other hand, Scots Pine does best; *Pinus Banksiana* Lamb. in spite of the small value of its wood is also recommended on account of its great hardiness which favours a quick recovery. As these species all require light, the plantations must be fairly thin, the trees 5 to 10 feet apart.

Clearings must then be made in succession and in this way, while obtaining an easily marketable product, the forest will eventually be com-

pletely reconstructed and rendered capable of again yielding marketable timber in its turn.

2) *Gaps of very small extent.* — When the gap left by the removal of the plants is not above twice the height of the surrounding trees in size, the use of pines, which require a particularly large clearing, is not possible. However, as the object is to plant trees capable of early utilisation, there are other species of conifers answering to this requirement, and among these the fir and spruce are preferable. Though they give a very thick shade, the pyramidal shape of their summits will give the minimum of inconvenience to the surrounding trees, especially to the deciduous species. The fir is most advisable from the cultural point of view and the spruce from the commercial standpoint. At the same time, this would be the best way to establish the fir in forests of deciduous trees and could only add to the value of the forest as a whole.

The writer also recommends the white fir (*Abies concolor* Lindl. and Gord.) characteristic for its hardiness and rapid growth. The wood, however, is mediocre though perhaps not more so than that of the fir cultivated at a low altitude. The Douglas fir (*Pseudotsuga Douglasii* Carr.) might also be recommended as it furnishes a first class wood and grows rapidly, but there are doubts as to its hardiness. In this connection the tested Colorado variety might be borne in mind, though it grows less rapidly.

If, finally, other deciduous species are preferred to the conifers mentioned above, one might use for the big clearings, birch and false acacia instead of pines. On the other hand, in the case of the small gaps beech, or better, ash, might be planted instead of firs and especially yew more which can do with a fairly poor amount of light (1).

159 – **The Importance of *Robinia Pseudo-Acacia* L. in the Afforestation of the Steppes in the Province of Iekaterinoslav (Russia).** — Колесниковъ Александръ (KOLESNIKOW, ALEXANDER), in *Лѣсное Хозяйство и Лѣсоводство* (*Forestry and Sylviculture*), Year LXXVI, Vol. CCLI, pp. 191-234. Petrograd, June 1916.

The afforestation of the Russian steppes was begun in the first half of the 19th. century, under the immediate influence exercised by the idea of creating better climatic conditions in those regions. In the history of this movement, the cultivation of the Robinia in purely forest plantations (this tree being first introduced into South Russia in the time of CATHERINE II. and cultivated as an ornamental plant) marks an important epoch.

In view of the easy reproduction, rapid growth and success of isolated plants of Robinia it was considered, especially towards 1880, as the most suitable species for the afforestation of the steppes. For example, in forest properties alone in the South Russian steppes, from 1874 to 1885 there were 558 hectares (1 hectare = 2.47 acres) under Robinia, and it

(1) See: A. JOLYET: 1) La restauration des forêts dévastées par les faits de guerre, in *La Vie agricole et rurale* V. pp. 241-246, 2 figs, 1915; — 2) Traité pratique de sylviculture Appendix, 6,191; 1916; — G. DEMORLAINE: 1) La restauration des forêts dévastées par la guerre, in *Revue des Eaux et Forêts*, LIV, pp. 222-228, 1916; — 2) La réparation des dommages de guerre aux forêts. *Ibid*, pp. 349-353. (*Ed.*).

other properties in the same region the planting of equally large areas was contemplated. However, the partisans of the Robinia were soon undeceived, for after the vigorous development of the initial years the pure plantations of this species (after some to 10 years) began to decline and eventually even to die out.

The cause of this instability of pure plantations must be attributed to the requirements of the Robinia which needs a large amount of light and can only prosper in such plantations when conditions are particularly favourable and when the strong competition of other plants is eliminated (sands with poor flora). On the clayey tchernoziom, where there is an abundant growth of herbaceous plants, the Robinia has been incapable of forming plantations of big trees owing to the early thinning of its foliage. Its feeble shade favours a strong development of grasses and subsequently the formation of a turfy layer which eventually involves the total failure of the plantation. Excessive crowding is also largely responsible for such a result. The effect of frost has only been felt in too low situations.

In the Department of Komisarovka in the forestal domain of Verkhnednieprovsk (province of Iekaterinoslav), during the period 1877 to 1885, 175 hectares were devoted to pure Robinia plantations, and 7 hectares to Robinia with *Acer Negundo*. At the present moment this area is 146 hectares. In the forest history of the Department of Komisarovka the following periods may be identified:

During *the* 1st *period*: from the institution of the Department in 1876 up till 1882, the Robinia predominates in pure plantations and is rarely associated with *Acer Negundo* L.

During *the* 2nd *period*: from 1882 to 1888, the leading place is taken by plantations of elms and ash, the oak being cultivated merely as an experiment.

During *the* 3rd *period*: from 1888 to 1894, the plantations have a mixed character and an important place is occupied by oak.

Since 1894, the oak has attracted still more attention and at the present day represents the principal species. All the care of the forester is devoted to the oak. At the present time, in recent plantations in the forest domain of Verkhnednieprovsk, the oak constitutes 33 % and sometimes even 50 % of the whole plantation.

After 1895, the cultivation of the false acacia was completely abandoned, not only in pure but also in mixed plantations. It was only after 1907, when the success of its association with oak and ash was noted, that it was again introduced, chiefly on account of its qualities as a protection of young oaks.

At the present time, the extent of these plantations in the Department of Komisarovka is 48 hectares. The type of plantation is not yet definitely settled: the Robinias are planted in lines, either alone or alternating with other species. In the latter case, when the oaks are cleared the Robinias are cut down to soil level and in the subsequent life of the plantation merely act as undergrowth of secondary importance. When planted in lines the real object is to obtain a sufficient number of plants

to distribute among schools and the population generally, which require large quantities.

At the present time, in mixed plantations of Robinia, it is usual to leave the land to cultivation for at least 2 years. In the autumn preceding the year of plantation the land is ploughed to a depth of 7 inches and left during the winter.

In spring, before planting, the land is harrowed, and after planting, when the weeds begin to appear, the rows are cleaned by hand, the cultivator being used between the rows. During the 1st and 2nd years there are four cleaning operations of each kind; during the 3rd year, three; during the 4th year, three with the cultivator and one by hand. After the 3rd or 4th year there is no further cleaning as the crowns of the trees begin to overlap and the weed growth disappears automatically as a result of the shade.

When the crowns begin to overlap and the species of more rapid growth than the oak begin to hinder this latter, they are cleared away. This is generally done in the 3rd year after the crowns have begun to touch.

The writer gives a profit and loss account based on data from the archives of the Forestal Department of Komisarovka relating to pure plantations of Robinia made in 1877, between the lines of which oaks were sown in the 2nd year, subsequently becoming the principal species. Calculating the annual interest at 4 % the following results are obtained per hectare (1 franc per hectare = nearly 4*d.* per acre): Expenses of laying down pure Robinia plantation 102.60 fr., and up to 1915: 455.70 fr.; cultivation during first 4 years (1st year, 32.10 fr. — 2nd year, 60.20 fr. — 3rd year 38.90 fr. — 4th year 23.30 fr.), up till 1915: 651 fr.; expenses for seed and cultivation of oak, up till 1915: 48 fr. The total expenses amount to 1154.70 fr. per hectare. As regards profits, the net gain from the sale of the Robinia alone, up to 1915, is 700.40 fr. per hectare; the oak which has replaced the Robinia would give, if cut, at current prices 960.40 fr. per acre.

According to these data the income from one acre of land has been as follows: 1) the lowest (— 15.60 fr.) for the pure Robinia plantation; better (— 7.70 fr.) for the plantation of oak alone; 3) better still (— 4.80 fr.) for the mixed plantation of Robinia and oak. If, in determining the income the annual interest is reckoned at 3.5 % or at 3 %, in the first case it is negative (— 2.30) and, in the second, it is positive (+ 0.30).

As regards the period of maximum increase of timber production there are no data for the past, but it is supposed to lie between 40 and 50 years.

The writer summarises the experiment of the forestal department of Komisarovka as follows:

On the clayey tchernoziom the Robinia has not proved capable of forming plantations of big trees. Plantation of low trees may live if the necessary thinnings are carried out at the proper moment. Such plantations may even be profitable if there is a demand for the wood they produce. However, the cultivation of such plantations is only of secondary

importance. The principal fact to note is the favourable action of the Robinia, evidently due to its biological properties, upon the development of the forest species which live, either contemporaneously with it in the same plantation, or upon the soil previously occupied by it. For instance, in the most recent plantations in the above-mentioned department, on land previously occupied by the Robinia, both oak and ash developed in equal measure, although it is general knowledge that the latter usually develops more rapidly. Similar phenomena have also been observed in plantations of Robinia associated with oak and other species. Thus it is with regard to its properties as a leguminous plant that the Robinia requires study.

The writer finally recommends, for trial purposes, the introduction of spineless varieties of Robinia such as *R. Pseudo-Acacia inermis* and *R. Pseudo-Acacia umbraculifera*. These varieties are less exigent with regard to their requirements in the way of cultivation and, further, seem more resistant to the new enemy of *R. Pseudo-Acacia* i. e. *Lecanium caprae* (1). Research on the biology and control of this insect is required.

HYGIENE OF LIVE STOCK.

190 - **The Treatment of *Enteritis paratuberculosa bovis specifica* by Methylene Blue** (2). — STUTE, in *Berlin Tierarztliche Wochenschrift*, Year 32, No. 50, p. 564. Berlin, December 14, 1916.

In September 1916, the Author found that the disease called *Enteritis paratuberculosa bovis specifica* had caused serious damage in a herd of 40 cows in West Prussia. Besides the disinfection of the shippons and isolation of infected animals, 2 grains of HOECHST methylene blue were ordered to be given per head on each of 5 consecutive days. Eight days after the first treatment, another was given, using the same amount. The animals under treatment gradually recovered and increased in weight. Judging from this result, the writer advises the study of the therapeutic value of methylene blue for this form of enteritis, as it is said by MARTENS-LANGERNHAUSEEN to be effective against swine fever.

191 - **Lupines as Poisonous Plants.** — MARSH, C. D. CLAWSON, A. B. and MARSH, HADLEIGH, in *U. S. Department of Agriculture, Bulletin* N° 405, 14 pp. 2 fig. + 4 plates. Washington, December 5, 1916.

Lupines have been cultivated and used from the time of the ancient Greeks and Romans, but their poisonous properties have been recognized only in very modern times. Heavy losses of domestic animals were reported in northern Germany in 1872 and the succeeding years.

While chemists have shown the presence of poisonous alkaloids in the lupines (dextrorotatory-lupanin, inactive lupanin, lupinidin [identical with sparteïn], oxylupanin), the losses in northern Germany have been considered by investigators (KÜHN, ROLOFF, ARNOLD and LEMKE, ARNOLD and

(1) See *B.* Jan. 1917, N° 110. (*Ed.*)
(2) See B. 1916, No. 877. (*Ed.*),

SCHNEIDEMÜHL, DAMMAN) as due not to the alkaloids but to a hypothetical substance known as ictrogen.

An investigation by Dr. SOLLMANN showed the presence of alkaloids in American lupines (*Lupinus sericeus, L. leucophyllys, L. cyaneus*) and pointed to the probability that most, if not all, of the poisoning of live stock in America was due to these alkaloids and not to ictrogen. These alkaloids are toxic or fatal if a sufficient quantity of the plant is consumed, but they are harmless if the consumption is below a certain limit. Up to this point the lupines may be a useful food if due precautions are observed that the limits are not surpassed. The alkaloids could also be largely removed by leaching with water. From SOLLMANN's results the following conclusions are drawn:

1. Feeding with the lupines does not produce any symptoms in rabbits and guinea pigs, as a sufficient quantity is not taken in this manner.

2. The injection of extracts, by stomach or skin, is fatal if sufficiently large doses are used.

3. No ictrogen was found in any of the six specimens.

4. The toxic constituents are alkaloidal and seem to agree with those of the European species.

5. These alkaloids produce a stimulation and then a paralysis of the following structures: the respiratory and vasomotor centres, some convulsive centres, the vagus end mechanism and perhaps the vagur centre. Large doses given intravenously paralyze the heart muscle. The convulsions do not appear to be purely asphyxial.

6. Pronounced symptoms are seen only when almost fatal doses are given: smaller amounts do not produce any conspicuous effects. When death does not occur acutely, there are no late effects. Repeated administration has no influence on the action.

7. The cause of death is paralysis of respiration. Death occurs with hypodermic administration, in 12 minutes to $2^1/_2$ hours. When given by stomach, in 10 minutes to $3^1/_4$ hours. The symptoms set in only shortly before death.

8. The fatal doses for rabbits by the stomach, figured for the original drugs, are as follows: for the seed of *Lupinus sericeus* and *L. leucophyllus*, between 30 and 50 grams per kg.; for the seed of *L. cyaneus* between 20 and 100 grams per kg.; for the hulls of *L. cyaneus* and *L. sericeus*, over 100 grams per kg.

9. The fatal dose of the crude alkaloid for rabbits, gastric administration, lies between 1.2 and 2.4 grams per kg.; for rabbits, hypodermic administration, between 0.123 and 0.246 gram per kg.; for guinea pigs hypodermic administration, between 0.062 and 0.1 gram per kg.; for dogs intravenous administration, about 0.012 gram per kg.

10. The fatal dose for rabbits is between 5 and 10 times as large when the alkaloids are given by the stomach as when given intravenously. Guinea pigs are more susceptible to the alkaloids than rabbits when the solutions are administered hypodermically.

11. In the treatment of the poisoning, artificial respiration was found

useless. Good results were obtained with potassium permanganate, diuretin, and tea.

Extended field work (from 1909 to 1914) has verified the conclusions of SOLLMANN and has shown that all aerial parts of the lupines examined (*L. comatus, L. myrianthus, L. leucopsis, L. argenteus, L. leucophyllus*) are poisonous, the seeds being the most toxic, then in order the pods and leaves. This has been confirmed by preliminary experiments with extracts upon mice.

The toxic substance is excreted by the kidneys; the intoxication is not cumulative, and animals may eat comparatively large quantities with no ill results, if the toxic limit is not reached at any one time. Inasmuch as the toxic and lethal limits are nearly the same, the prognosis for poisoned animals is not favorable.

There is no form of remedial treatment that can be used advantageously for range animals. Poisoning in most cases can be avoided, even where the plant is abundant, by careful handling of the flocks, especial care being taken to see that hungry sheep are not grazed on fields where there is much lupine.

p2- **The Effects of Feeding the Proteins of the Wheat Kernel at Different Planes of Intake.** — MCCOLLUM, E. V., SIMMONDS, N. and PITZ, W., in *The Journal of Biological Chemistry*, Vol. XXVIII, No. 1, pp. 221-229, 17 Diagrams, Baltimore, Md., December 1916.

It has now been fully established that there are great variations in the biological values of proteins from various sources, which depend upon the proportions of the amino-acids they yield on digestion. (MCCOLLUM, E. V., *The Journal of Biological Chemistry*, 1914, XIX, 323; MCCOLLUM, E. V. and DAVIS M., *ibid.* 1915, XX, 415; OSBORNE T. B. and MENDEL, L. B. *ibid.* 1915, XX, 315) (1). It is not yet apparent whether an animal is as well off physiologically with a ration, otherwise satisfactorily constituted but containing a high content of protein of low value as with the same food mixture with its low grade protein replaced by its biologically equivalent amount of a much better protein. In the present paper the writers attempt to throw light on this problem. Their experiments were made with rats. The results are summarized as follows:

1. In agreement with former experience with the feeding of diets having a high wheat content emphasis must again be laid on the marked inferiority to the progeny which results from such restricted diets.

2. The writers were unable to make up a ration containing wheat proteins only which was adequate for the rearing of the young, although the protein content was varied from 6.5 per cent. to 47.98 per cent. Over a wide range of protein content growth approximated to the normal, but pronounced injurious effects of the ration were revealed in the reproduction records only.

3. The addition of 10 per cent. of casein to a ration which contained 9.33 per cent of protein from wheat, and which was satisfactory with respect to all dietary factors other than protein and an inherent toxicity, improved the ration in a marked degree.

(1) See also *B.* 1915, Nos. 72 and 73. (*Ed.*).

4. Growth was not interfered with by including as much as 40.45 per cent. of wheat proteins in the diet, but on this the young could not be reared.

5. Growth was normal and the production of young was good on a diet containing 46.63 per cent. of protein, of which 43.0 per cent. was casein and 3.63 per cent. wheat proteins. The cause of the failure to rear the young on this diet has not yet been definitely ascertained, but would appear to be due in great part at least to the shortage of the supply of the dietary factor B, the sole source of which was the 33 per cent. of wheat in the food mixture.

6. As small an amount as 15 per cent. of whole wheat as the source of the water-soluble B, suffices for the completion of growth in the rat and so promotes well-being as to induce the production of a nearly normal number of young. The amount of this substance is not great enough to enable the young to develop to weaning age without causing pronounced nervous disturbances which end in death.

103 - **Dietary Deficiencies of the Maize Kernel.** — McCOLLUM, E. V., SIMMONDS, N. and PITZ, W., in *The Journal of Biological Chemistry*, Vol. XXVIII, No. 1, pp. 153-165, 1 diagrams. Baltimore, Md., December, 1916.

In the present paper the writers present the results of a systematic series of experiments with ground maize in which single or multiple additions of purified food substances were made. These included protein, inorganic salts, and butter fat to supply the unidentified dietary factor, the fat-soluble A. Numerous experiments have shown that the second as yet unidentified dietary factory, the water soluble B, is furnished in great abundance by even 70 per cent. of maize in the diet.

The method of procedure was similar to that described by the writers, in connection with their studies of the dietary deficiencies of wheat, rice and wheat embryo (1) and the results make it clear that the dietary properties of the maize kernel are very closely similar to those of the wheat kernel. The experiments were made with rats. The conclusions are summarized by the writers as follows :

1. The proteins of the maize kernel contain all the amino-acids essential for growth, but the proportions of certain of them are such that they are not utilizable to a high degree as the sole source of protein. When other factors affecting nutrition are properly adjusted, growth has occurred at about two-thirds the normal rate over a period of 6 or 7 months, on a diet in which all the protein was derived from 91 per cent. of ground maize in the ration (9 per cent. of N $\times$ 6.25).

2. The maize kernel contains both the unidentified dietary factors, the fat-soluble A and water-soluble B. The former is present in too small amount for the maintenance of growth at the maximum rate in rats, and regardless of how satisfactorily the maize kernel is supplemented in other respects, failure of perfect nutrition will supervene within a few months unless some foodstuff containing the fat-soluble A (butter fat, certain other

(1) Mc COLLUM E. V. and DAVIS, M., *The Journal of Biological Chemistry*, 1915, Vol. XX[illegible] p. 615-643. See also *B.* Dec. 1915, No. 1316. [Ed.]

fats, leaves of plants, etc.) is supplied. Hot alcohol extracts the fat-soluble A from the maize kernel. The low content of the dietary A of maize was supplemented whit an alcoholic extract of maize and development was induced more closely approximating the normal than without this addition, followed by reproduction and rearing of the young.

3. Like other grains which were studied, maize contains an abundance of the unidentified dietary factor, the water-soluble B. This is made evident by the fact that the maize kernel can be supplemented so as to produce normal nutrition by the addition of a suitable purified protein, inorganic salts, and butter fat, none of which carry the dietary factor.

4. The inorganic content of the corn kernel is not of a character suitable for the promotion of growth. It was found necessary in all cases to make salt additions to rations deriving their inorganic contents principally from this source, regardless of the nature of the other purified food ingredients added, before growth could take place.

5. The addition of purified protein and salts or of butter fat and salts to the maize kernel fails to induce physiological well-being throughout the life of the animal. The addition of protein and butter fat without salts forms a poorer food mixture than the pairs of additions first named. While pigs grew during several months when the diet was restricted to the maize kernel fortified with additional maize protein (gluten feed) and inorganic salt additions perfectly normal reproduction has never been observed on such rations. Young were born but the mother failed to rear them. This ration was directly comparable with that of the lot receiving the ration: maize 73, casein 18, salt mixture 3.7, agar 2, dextrin 3.1 per cent.: the dextrin carried the alcoholic extract of 5 grams of wheat embryo.

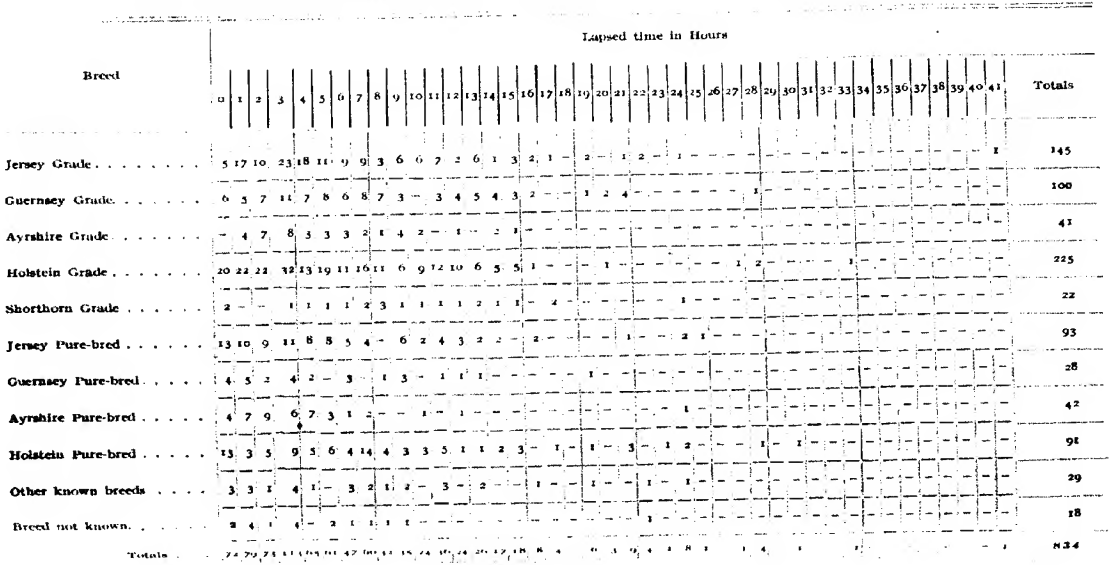
The experiments here reported with rats confirm the writers' previous observations with swine on certain rations derived solely or principally from the maize kernel and extend the experimental data relative to the quantitative values of the maize kernel as respects the several dietary factors. The results of feeding high planes of intake of maize proteins will be published later.

The writers attempted several times to nourish young rats with a diet restricted to the germ of the maize kernel, and to mixtures of the maize germ and whole ground maize in several proportions. These attempts have been uniformly unsuccessful. Two samples of germ from different dealers were employed. It is not certain just what treatment these had received, but both appeared to be wholesome products. It is evident from these trials that it is not easy, if at all possible, to make up a satisfactory ration wholly derived from the corn kernel and its parts. The nature of the dietary deficiencies of the corn germ constitutes a problem in itself.

14- **The Normal Duration of Heat (*Oestrum*) in Cattle.** — PEARL RAYMOND, in *Maine Agric. Exp. Station, Report of Progress on Animal Husbandry Investigations in 1915*, No. 310-12-15, pp. 16-18. Orono, Maine, 1916.

The agricultural Station of Maine has extensive data bearing on the duration of heat in cattle. These data arranged in the table show, for various breeds, the number of hours that elapsed between *a*) the time when the

The Time in Hours between the Observance of Heat and Successful Service of the Cow.



Breed	Lapsed time in Hours: 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	Totals
Jersey Grade	5	17	10	23	18	11	9	9	3	6	6	7	2	6	1	3	2	1	–	2	–	1	2	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	145
Guernsey Grade	6	5	7	11	7	8	6	8	7	3	–	3	4	5	4	3	2	–	–	1	2	4	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	100
Ayrshire Grade	–	4	7	8	3	3	3	2	1	4	2	–	1	–	2	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	41
Holstein Grade	20	22	22	32	13	19	11	16	11	6	9	12	10	6	5	5	1	–	–	1	–	–	–	–	–	1	2	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	225
Shorthorn Grade	2	–	–	1	1	1	1	2	3	1	1	1	1	2	1	1	–	4	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	22
Jersey Pure-bred	13	10	9	11	8	8	5	4	–	6	2	4	3	2	2	–	2	–	–	–	1	–	–	2	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	93
Guernsey Pure-bred	4	5	2	4	2	–	3	–	1	3	–	1	1	1	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	28
Ayrshire Pure-bred	4	7	9	6	7	3	1	2	–	–	1	–	1	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	42
Holstein Pure-bred	13	3	5	9	5	6	4	14	4	3	3	5	1	1	2	3	–	1	–	1	–	3	–	1	2	–	–	1	–	1	–	–	–	–	–	–	–	–	–	–	–	–	91
Other known breeds	3	3	1	4	1	–	3	2	1	2	–	3	–	2	–	–	1	–	–	1	–	–	1	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	29
Breed not known	2	4	1	4	–	2	1	1	1	1	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	18
Totals	74	79	75	113	66	61	42	60	33	38	24	36	24	26	17	18	8	4	0	3	3	9	4	3	8	1	–	1	4	–	1	–	–	1	–	–	–	–	–	–	–	1	834

breeders observed that the cow was in heat and *b*) the time when she was served by the bull.

From this table the following constants were deduced :

	Average number of hours from
Discovery of heat to service.	6.357 ± 0.134 hrs.
Standard Deviation	5.737 ± 0.095 hrs.
Coefficient of Variation	90.25 per cent.

From these data it appears that successful fecundation of the cow may occur as many as $41 + x$ hours after the onset of heat. The value of x is not quite certain, but it is probably small. While, in isolated cases, successful service after as much as 41 hours may occur, the majority of successful services occur at much shorter time intervals. In fact, over 79 per cent. out of 834 successful services occurred within 10 hours after the onset of oestrum.

There appear to be no important differences between the different breeds.

Further work on this subject, in which successful and unsuccessful services will be compared, is now in progress.

65 - **The Future Utility of the Pessina Method for Determining the Age of Horses.** — DISSELHORST RUDOLF, in *Kühn-Archiv*, Vol. 6, Second Half Vol. pp. 297-325. Halle a. S. 1916.

The PESSINA method for determining the age of horses by their teeth is about a hundred years old. The method has often been severely criticised but without effect. Of late, age determinations of horses whose age was known have shown that the Pessina method is only trustworthy within wide limits. The researches of HEINZE, ACKERKNECHT, and MÜLLER and SCHWERDT may be mentioned in this connection.

The writer has made a thorough examination of the incisors derived from the skeletons of 42 horses and mules the ages of which were exactly known. He has also examined 12 entire skulls of solipeds bred at the Zootechnical Institute of Halle University and of which consequently the ages were also known. Finally, records were taken of the dental measurements of a large number of horses, asses and mules, still living and of known ages. The measurements were taken by means of a specially constructed rule.

The results obtained are compared with those of PESSINA. The conclusions may be summarised as follows :

1) In many cases, the observations on the cups (infundibula) in the crowns of the teeth are not in agreement with PESSINA's data. The majority of times, the age determined in this manner is in excess of the reality. The depth of the cup, particularly, is quite irregular.

2) The cups do not always disappear from the incisor of the upper jaw, in spite of these being the longest teeth. It was by no means rare to find more or less distinct traces among these teeth, whereas the infundibulum had practically disappeared from the corner tooth, which is shorter.

Traces of cups were found in the middle and corner teeth of one side of a thoroughly old horse (32 years).

3) Both in transversal and longitudinal section the grinding surfaces of the teeth in cart-horses are always 1 or 2 mm larger, but in this respect there is a good deal of variation, both between the teeth of the same jaw and between those of upper and lower jaws. The triangular form has been found to occur in a horse as young as 6 years old, and conversely, the oval form has been found in the upper jaw of a horse 18 years old.

4) In nearly all mouths, even in those of very young colts, the lower jaw is longer than the upper; it is very rare to find a pure type of bowshaped jaw (1). Such jaws are seen, however, (asses, mules) up to an advanced age, whereas the semi bow-shaped jaw predominates among horses of any given age and may be seen to a certain extent even at the most advanced age (32 years). On skeletons at any rate this feature is incapable of serving even as an approximate indication of age. It is impossible to say of what age an angular jaw is indicative. In living subjects the gums give a somewhat different conformation to the jaws, and bow-shaped jaws are no longer seen. Here again the writer has noted from the few jaws examined, that the same form occurs in animals of fairly widely differing ages.

5) The labial walls of the alveolar processes in 3 year old colts are already shorter than the lingual walls; as the teeth increase in length, that is to say, as the animal grows older, they recede still further The lateral walls remain for the greater part of the time at the same level.

6) As regards the "tushes", their appearance, change of shape and wear, they exibit such variations as to lose all importance in the dermination of age. By no means rarely they are completely lacking in the mare; on the other hand they are often present in both jaws.

7) The time of appearance of the V shaped groove is quite irregular, it is often observed in animals as young as 7 years. Consequently it is of no value for age determination.

166 – **Cattle in Asturia, Spain.** — Naredo Manuel and Bajo Federico, in *La Industria Pecuaria*, Year XVII, Nos. 537 and 538, pp. 852-855, 862-865 + 2 plates Madrid, Dec. 15 and 20, 1910.

The local race of Asturian cattle shows two types perfectly distinct from one another, namely the mountain and the plains type and in addition a fair number of half-breeds, the result of crossing various foreign breeds with the native animal. The mountain type inhabits the regions of high and of average elevation; the plains type and half-breeds the coastal region and fertile valleys of the interior.

The Mountain type. — Is found perfectly pure in the most inaccessible parts of the province and more particularly in the Communes of Allei and Caso. The hide is light red, lighter on the forelimbs; nearly white on the belly and the extremities of the limbs. Table I gives the averages o

(1) By bow-shaped, semi bow-shaped and angular jaws are meant the different forms take by the rows of incisors of both jaws as the animal grows older.

the measurements made by the writers. It is seen that during early life, development in length is more pronounced than development in height, and that these beasts are very narrow chested, a fault which must be corrected. Another drawback is their slowness in coming to maturity, being first properly developed at the age of 5 to 6 years.

The quantity of milk produced varies from 800 to 1100 litres (1 litre = 0.22 gall.) during the lactation period, which lasts about 6 months; as the weight of cows above 3 years is about 335 kg., milk production varies between 1.32 and 1.82 % of the live weight. The milk is of good quality, its richness in dry matter and fat never dropping below 13 % and 4.5 % respectively; in some individuals the proportion of fat reaches 6 %

TABLE I. — *Measurements of Mountain Cattle (Average Values)*

	Females		Males	
	aged from 2-4 years	more than 4 years	Aged from ½ to 3 years	More than 3 years
Height: to sacrum . . . . . cm	114.80	120.30	117.12	126.33
» » mid-rump . . . . . »	110.63	117.40	113.16	122.16
» » attachment of pelvis . . »	118.80	124.10	122.04	128.66
» to insertion of tail . . . . . »	119.00	125.30	125.20	133.50
Length of trunk . . . . . »	133.20	140.30	133.48	147.00
Height of thorax . . . . . »	60.00	63.70	61.44	68.00
Width » » . . . . . »	33.10	36.20	36.84	39.00
Length of pelvis . . . . . »	44.00	46.60	45.72	50.50
Width » » . . . . . »	38.50	40.30	38.60	41.83
Girth of chest. . . . . »	157.00	166.90	160.68	181.00
» » cannon bone. . . . . »	16.00	16.80	18.36	20.33
Dactylo-thoracic index . . . . . »	1 : 9.8	1 : 9.9	1 : 8.6	1 : 8.8
Live weight . . . . . kg	290	350	300	450

During the period of active growth, which usually begins after the second year, these animals assimilate their food well, as proof of which the following fact is quoted: 16 animals, aged from 2 to 2 ½ years, on good pasture from the 20th September to the 1st November 1915, increased from an initial live weight of 1835 kg. to 2303 kg. a total gain of 468 kg., or 25 % of the initial weight. The fine frame and the good quality of the meat are qualities of considerable value in the fattening of mountain cattle. They are also good work animals, on account of their docile temperament, well developed muscles and general build; however, in view of the small areas under cultivation in the stock-raising districts, the capacity for milk and meat production is more important. Thoroughly well adapted to local conditions owing to its small build and great hardiness, this type is incapable of being replaced in any part of the mountainous regions of the pro-

TABLE II. — *Measurement of Plains Cattle (Average values).*

		Males and females up to 1 year	Females			Males	
			1-2 years	2-4 years	over 4 years	1-2 years	over 2 years
Height to sacrum	cm	120.30	130.00	135.75	141.85	137.00	141.00
» » mid rump	»	115.62	126.75	129.75	136.37	133.75	136.00
» » attachment of pelvis	»	126.49	135.00	140.50	145.25	143.75	146.00
» » insertion of tail	»	130.50	138.75	144.75	150.72	148.00	150.00
Length of trunk	»	141.70	145.00	156.50	166.14	158.50	165.00
Height of thorax	»	59.75	67.25	70.75	72.70	69.00	73.50
Width » »	»	37.37	43.75	46.25	47.14	46.50	47.50
Length of pelvis	»	46.37	47.75	52.00	55.85	55.25	58.50
Width of pelvis	»	40.12	44.25	48.25	52.69	48.25	53.00
Girth of chest	»	164.24	179.75	194.00	205.28	197.25	219.00
» » cannon bone	»	19.67	20.50	20.50	21.35	22.25	25.00
Dactylo-thoracic index	»	1:8.3	1:8.7	1:9.4	1:9.6	1:8.8	1:8.7
Live weight	kg	316	430	560	600	590	700

vince. By selection and proper feeding it would be easy to produce a quicker maturing animal and to improve the milk and butter yielding capacity; in fact, this has already been proved by the writer's experiments. For instance, a cow weighing 435 kg. consumed on an average, during a period of 111 days (Dec. 1 to March 25), 10.99 kg. of dry matter per day (hay, straw, mangolds, and for 30 days a little coconut cake) equivalent to 4.11 nutritive units; the milk production was 9.88 litres daily with a fat content of 4.75 %. This means that in order to produce 1 kg. of milk, during the period of the experiment, 1.11 kg. of dry matter and 0.41 nutritive units were required.

The Plains type. — The hide varies from light to dark red in colour and sometimes to light chestnut.

The data in Table II show the strong development of this race; the conformation of the back is poor; the chest is better formed than in the mountain race; the pelvis is somewhat short but amply wide.

Milk production varies from 1 700 to 1900 litres. This type is an early maturing one, strong and stands well. It promises well both as a work animal and for meat production. Selection should aim at improvement along both these lines.

Crosses. — The above types have both been crossed with foreign breeds for some time past but no definite plan has been followed. As a consequence, along the coast and in the valleys where crossing has been most general, the herds have become rather heterogeneous in character. The foreign breeds most frequently used are Dutch and Schwitz, and occasionally Simmenthal, Durham and Flemish also.

The offspring of crosses with the Dutch breed are good as regards milk production but are not strong work animals; they are exigent as regards food, require a lot of care and considerable preparation for slaughtering. On the other hand their greater food requirements are compensated by greater milk production.

Crossing with the Schwitz breed gives an animal capable of turning its food to better account than the local breed.

Milk production, however, varies, being sometimes greater and sometimes less than that of the native type. Generally speaking these half-bred cows give less milk than the native cows during the 1st and 2nd. lactation periods, but yield more subsequently. Further, the actual lactation period is always longer than in the local type. As regards amount of work these animals are superior to those obtained by crossing with any other foreign breed whatsoever. Consequently it may be said that the crosses between the native and Schwitz breeds give a good result from all points of view: beef, milk and work.

Comparative Table of Milk Production in Dairy Herds in Relation to Age and Duration of Lactation, in the United States (1). — PEARL RAYMOND, in *Maine Agricultural Experiment Station, Report of Progress on Animal Husbandry Investigations in 1915*, No. 51-c12-15, pp. 3-8. Orono, Maine, 1916.

Statistical date provided by milk records of various societies, suitably ualised, have been used by the Maine Agricultural Station, under the rection of the writer, in order to compare milk production in dairy herds ith the age and the duration of lactation. The Table thus prepared gives comparison between 2 dairy herds under different conditions as regards ge and period of lactation of the individual animals in the herds.

The following example shows the method of use of this Table.

Given the herds made up as shown in Table II, then on Oct. 1, 1915, e average efficiency percentage would be:

	Herd A	*Herd B*
r cows that have calved . .	$\frac{538\ ^{0}/_{0}}{14} = 38.43\ ^{0}/_{0}$	$\frac{893\ ^{0}/_{0}}{18} = 49.61\ ^{0}/_{0}$
r cows in milk	$\frac{538\ ^{0}/_{0}}{11} = 49.00\ ^{0}/_{0}$	$\frac{893\ ^{0}/_{0}}{14} = 63.79\ ^{0}/_{0}$

The amount of milk produced on Oct. 6, 1915 being 250.5 lbs. for rd A, and 289.4 lbs. for Herd *B*, the following figures for individual pro-ction, equalised and not equalised, were obtained

	Herd A	*Herd B*
rage for cows that have calved . .	$\frac{260}{14} = 18.57$ lbs	$\frac{290}{18} = 16.1$ lbs.
rage per cow not milking	$\frac{360}{11} = 23.04$ lbs.	$\frac{290}{14} = 20.7$ lbs.
culated total milk if herd was at 100 % efficiency	$\frac{26\,000}{38.43} = 676.6$ lbs.	$\frac{29\,000}{49.61} = 584.6$ lbs.
rage per cow . . . . . = 48.2 lbs.		32.5 lbs.

(1) See also No. 182 of this *Bulletin*. (*Ed.*)

TABLE I.

Comparative Table showing milk production in relation to age and the duration of lactation.

Age of the cow in years and months	Months since feahening (Stage of Lactation)																							
	1	2	3	4	5	6	7	8	9	10 *	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1:6 — 1:11 . .	58%	54%	51%	47%	44%	41%	37%	34%	30%	27%	27%	27%	26%	26%	26%	26%	26%	26%	25%	25%	25%	25%	25%	25%
2:0 — 2: 5 . .	73	69	64	60	56	52	48	43	39	35	35	35	34	34	34	34	34	34	33	33	33	33	33	33
2:6 — 2:11 . .	82	77	72	67	62	57	52	47	41	36	36	36	36	36	35	35	35	35	35	34	34	34	34	34
3:0 — 3: 5 . .	89	83	77	71	66	60	54	48	43	37	37	37	37	37	36	36	36	36	36	35	35	35	35	35
3:6 — 3:11 . .	93	87	81	75	69	62	56	50	44	38	38	38	38	38	37	37	37	37	37	36	36	36	36	36
4:0 — 4:11 . .	97	91	84	78	71	65	58	52	45	39	39	39	39	38	38	38	38	38	37	37	37	37	37	36
5:0 — 5:11 . .	100	93	86	79	72	66	59	53	46	39	38	38	38	38	38	37	37	37	37	37	37	36	36	36
6:0 — 6:11 . .	100	93	86	79	72	65	58	52	45	38	38	38	38	37	37	37	37	37	36	36	36	36	36	35
7:0 — 7:11 . .	99	92	85	78	71	64	57	51	44	37	37	37	37	37	37	36	36	36	36	36	35	35	35	35
8:0 — 8:11 . .	97	90	84	77	70	63	56	50	43	37	37	37	37	37	36	36	36	36	36	35	35	35	35	35
9:0 — 9:11 . .	94	88	82	75	69	62	55	49	43	36	36	36	36	36	36	35	35	35	35	35	35	34	34	34
10:0 — 10:11 . .	91	85	79	73	67	61	54	48	42	36	36	36	36	36	35	35	35	35	35	35	34	34	34	34
1,0 — 11:11 . .	88	82	76	71	65	59	53	47	41	35	35	35	35	35	35	34	34	34	34	34	33	33	33	33
12:0 — 12:11 . .	85	80	74	68	63	57	52	46	40	35	35	35	35	35	34	34	34	34	34	33	33	33	33	33
13:0 — 13:11 . .	82	78	72	66	61	55	50	45	39	34	34	34	34	34	33	33	33	33	33	33	32	32	32	32

* From this sign to the end of the table the figures apply only to cows not utilised for breeding, and thus having a prolonged period of lactation. For cows whose lactation period finishes before this, the curve decreases rapidly to zero. For this Table, it is sufficiently accurate to consider that the average percentage of efficiency in a cow in the month when lactation ends is the half of the figure indicated for that month and for the respective age of the cow.

TABLE II.

Composition of the Dairy Herds A and B, October 6, 1915.

Herd *A*						Herd *B*					
Progressive number of cows and heifers	Cows in milk and dry	Date of the last calving	Age in years	Months in milk	Percent of equalisation (Table I)	Progressive No. of cows and heifers	Cows in milk and dry	Date of the last calving	Age in years	Months in milk	Percent of equalisation
1	in milk	Jan. 1915	6	9	46 %	1	—	heifer	2	—	—
2	in milk	Dec. 1914	4	10	38	2	—	heifer	2	—	—
3	in milk	Sept. 1915	11	1	88	3	in milk	Sept. 1915	3	1	89 %
4	in latt.	Mar. 1915	7	7	58	4	in milk	Sept. 1915	2	1	73
5	in milk	April 1915	7	7	58	5	in milk	Nov. 1914	3	11	36
6	in milk	Jan. 1915	9	9	43	6	dry	Aug. 1914	3	—	0
7	in milk	Jan. 1915	2	9	30	7	dry	July 1914	3	—	0
8	in milk	Dec. 1914	2	10	27	8	in milk	Dec. 1914	4	10	38
9	in milk	Feb. 1915	2	8	34	9	in milk	April 1914	6	18	37
10	in milk	Dec. 1914	2	10	27	10	in milk	Sept. 1915	2	1	73
11	dry	Oct. 1914	6	—	0	11	in milk	Sept. 1915	3	1	89
12	dry	Oct. 1914	5	—	0	12	in milk	Sept. 1915	3	1	89
13	dry	April 1915	8	—	0	13	in milk	Feb. 1915	6	8	53
14	—	heifer	1	—	—	14	in milk	April 1915	8	6	63
15	—	heifer	1	—	—	15	in milk	May 1915	8	5	70
16	—	heifer	1	—	—	16	in milk	Mar. 1915	12	7	53
17	—	heifer	1	—	—	17	in milk	April 1915	12	6	57
18	—	heifer	1	—	—	18	dry	Oct. 1914	6	—	0
19	—	heifer	1	—	—	19	dry	Oct. 1914	3	—	9
20	in milk	Sept. 1915	3	1	89	20	in milk	Sept. 1915	2	1	73
Total: in milk 11 milking 14					*Total* 528	*Total*: in milk 14 milking 18					*Total* 893

This Table shows that *Herd A* is formed of much better cows than *Herd B*, the average production per cow on the same efficiency of operation basis being about 16 lbs. per day higher in the former than in the latter. In fact, Herd A is one of the best herds of pure-bred Holstein Friesian cattle in Maine, while B is only a fair average herd.

Table I also can be used for the comparison of individual cows; it forms a much more scientifically accurate basis for the age correction of advanced registry records than do the rules of entry to advanced registry of any association in the United States.

168 - **Comparison of American Advanced Registry Ayrshires with Ayrshires in Scotland in Respect of Milk Production.** — PEARL RAYMOND, in *Maine Experiment Station Report of Progress on Animal Husbandry Investigation in 1915*. No. 519-12-15, pp. 2-5. Orono, Maine, 1916.

From a comparison made by the Maine Experiment Station between the American Advanced Registry Ayrshire Records and the Scottish Milk Record Society Ayrshire Cows Records it appears that the American Advanced Registry Ayshires outyield their Scottish sisters, on the average, from about one and a quarter gallons to three gallons per week, or roughly from 10 to 25 pounds. Looked at from a relative standpoint it appears that the American Advanced Registry Animals give, as two year old heifers or as mature cows, about 9 per cent. on the average more milk than the Scottish herds. For the three year and four year ages the percentage is higher.

The standards for admission to advanced registry are just as high for the Ayrshire as for any other breed. It appears a fair question as to whether a standard which runs less than 10 per cent. above the general average of the breed for mature cows, is sufficiently high to get the best results in the direction of breed improvement. The records of the Scottish Society correspond to American cow-test associations records in this particular that the records of *all cows* in each herd, good, bad, and indifferent, are included.

The results of such comparisons are shown in Table I.

Age of Cow	American Advanced Registry	Scottish Milk Record Society	Difference
	gallons per week	gallons per week	gallons per week
Two years	14.84 ± .08	13.61 ± .18	1.23
Three years	16.76 ± .14	13.84 ± .04	2.92
Three years	17.47 ± .11	15.23 ± .06	2.24
Mature	20.32 ± .13	18.56 ± .09	1.76

169 - **The Value of Prickly-Pear as a Cattle Feed: Experiments made at the Prickly Pear Feeding Station at Wallumbilla, Queensland, Australia** (1). — I. SMITH FRANK The Experimental Feeding of Cattle with Prickly-Pear, in *Queensland Agricultural Journal*, Vol. VI, Part IV, pp. 230-242. Brisbane, October 1916. — II. The Prickly-Pear Stock Feeding Experiment Station, Wallumbilla, *Ibidem*, pp. 243-244.

The objects of the experiments carried out at the above-mentioned Station were as follows:

(1) See *B.* 1915. No. 299; *B.* 1916 No. 305.

1) To ascertain the value of the prickly pear as a stock food.

2) After having established the nature of, and the limitation to, its utility, to discover a system of feeding the prickly-pear that will give the best results in practice.

3) To investigate and to demonstrate the results accruing when it is rationally employed as a component of rations for — the maintenance herds — fattening purposes — milk production — raising young stock.

In the experiments made hitherto, 18 young bullocks were used ; the animals were divided into 3 lots and stall-fed, the following rations being given :

Lot I : Ration consisted exclusively of prickly-pear fed until the animals began to waste.

Lot II : Base ration of prickly-pear + lucerne hay and oil cakes.

The prickly-pear used was the *Opuntia inermis* of West Queensland, and it was given to the animals simply sliced, without being boiled or roasted previously. When fed alone, the scrub-pear soon produced a rapid loss of weight ; when other food was added, it had no bad effects.

On the other hand, it has been demonstrated that the *Opuntia* is able to furnish sufficient water to prevent the animals requiring to drink. In fact, in the present experiments, the bullocks have not had any water for 4 months, and still show thrifty condition and no noticeable desire to look for water ; this may be explained by the fact that the animals receiving a minimum of pear are provided through that medium with from 4 to 4 1/2 gallons per day.

The addition of minimum amounts of ordinary hays to the prickly-pear ration (lot II) has maintained weight, but resulted in a noticeable depreciation in the appearance of the animals as compared with that of the bullocks of lot III which received additional food in the form of small quantities of lucerne hay and relatively small quantities of oil-cake. The cost of the complementary nutrients works out at a little more than 2 d. per head, per day.

1710- **Sheep Feeding Experiments in Kansas.** — *Kansas Agricultural Experiment Station Directors' Report* 1914-1915, pp. 25-27 ; Manhattan, Kansas, 1916.

A sixty-day feeding experiment to determine methods of utilizing forage and other roughage abundant on the average Kansas farm was undertaken at the Kansas Agricultural Experiment Station. A lot of 313 western range lambs, averaging 54 pounds each was purchased on the Kansas City market at a cost of $ 7.30 per cwt. Ten days after purchase these lambs were divided into six lots, and an experiment begun to determine the comparative value 1) of corn and kafir as grain, 2) of alfalfa and cowpea hay as roughage, 3) of sorghum as silage or hay and 4) of ground versus unground kafir. The lambs were fed so as to make a maximum use of roughage. Cottonseed meal was fed equally in all lots. The following table gives the results of this experiment:

Lamb feeding Experiment.

Rations	Lot 1. Shelled corn, Cotton-seed meal, Alfalfa hay, Silage	Lot 2. Shelled corn, Cotton-seed meal, Cowpea hay, Silage	Lot 3. Shelled corn, Cotton-seed meal, Alfalfa hay, Sorghum hay	Lot 4. Shelled corn, Cotton-seed meal, Alfalfa hay	Lot 5. Kafir, Cotton-seed meal, Alfalfa hay, Silage	Lot 6. Ground Kafir, Cotton-seed meal, Alfalfa hay, Silage
No. lambs in lot	50	50	50	50	50	50
	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
Average initial weight	56.7	55.9	56.6	56.7	55.4	57.5
Average final weight	80.9	77.3	80.4	80.4	76.6	79.1
Average total gain in 60 days	24.2	21.4	23.8	23.7	21.2	21.6
Average daily gain in 60 days	0.4	0.35	0.39	0.39	0.35	0.36
Average daily ration:						
Grain	0.89	0.90	0.9	0.9	0.9	0.9
Cottonseed meal	0.19	0.19	0.19	0.19	0.19	0.19
Alfalfa hay	1.35	—	1.36	1.78	1.36	1.36
Other hay	—	1.53	0.43	—	—	—
Sweet sorghum silage	1.09	1.09	—	—	1.09	1.09
Feed per 100 lbs. gain:						
Grain	222.13	252.99	227.25	228.01	254.4	250.0
Cottonseed meal	46.86	53.45	48.01	48.17	53.75	52.8
Alfalfa hay	335.58	—	344.77	450.96	385.01	378.36
Other hay	—	431.57	110.58	—	—	—
Sweet sorghum silage	271.11	307.06	—	—	308.76	303.43
	$	$	$	$	$	$
Cost of 100 lbs. gain	5.60	6.19	5.52	5.73	6.03	6.18
Cost of total feed	1.35	1.32	1.31	1.35	1.28	1.33
Initial cwt. value	7.30	7.30	7.30	7.30	7.30	7.30
Final cwt. value	8.05	8.05	8.00	7.90	7.90	8.05
Average initial value of lamb	4.14	4.08	4.13	4.14	4.04	4.20
Average final value of lamb	6.51	6.27	6.43	0.35	6.05	6.37
Average profit on lamb	1.02	0.82	0.99	0.86	0.73	0.84

Price of grain per cwt.: Shelled corn, $1.25; Kafir, $1.10; ground Kafir, $1.20; cottonseed meal, $1.30.

Price of roughage per ton.: Alfalfa hay, $10; cowpea hay, $8; sorghum hay, $6; sweet sorghum silage, $4.

Price of lambs per cwt.: The initial value is 60 cents per cwt. higher than the market cost, to cover expense of shipping lambs to the feed lot; the final value is 60 cents lower than market price, to cover expense of shipping them to market.

The combination of shelled corn, cottonseed meal and silage resulted in the most rapid gains, the lowest cost of production, and the greatest profit. Cowpea hay can be substituted for alfalfa in those sections of the State where it is advisable to grow it. The lambs which received alfalfa hay without silage did not in any way give as satisfactory returns as those having silage as part of the ration.

There was no advantage gained by grinding kafir.

Sheep raising has proved to be an extremely profitable industry in those sections of the State adapted to the growing of grass and other roughage. Sheep require more fencing and more care and better housing facilities than cattle under similar conditions. Where sheep are handled as one of the main sources of income it is necessary that the unit be large enough to utilize labor economically. A small flock on the farm can usually be maintained with comparatively little expense for feeds and with labour that would otherwise be considered of little or no value.

171 - **Pumpkins as Food for Sheep.** — FAULKNER, A. F., in *The Journal of Agriculture*, Vol. XIII, No. 4, pp. 266-268, 1 Fig. Wellington, October 20, 1916.

The writer indicates the satisfactory results he has obtained in growing pumpkins for sheep-feed in Wairakaia, Gisborne, New Zealand. They were grown according to the following method: the land is ploughed before the middle of August, worked fine in September, then tine harrowed once a fortnight to destroy any weeds. Sowing is done in October on the flat in rows 16 to 18 ft apart and in clumps of 3 seeds a yard apart in the row. With a single-furrow plough a man can line out rows of 16 to 18 feet apart at the rate of about 16 acres a day, and 4 men or boys can sow 16 acres a day using 4 to 6 lbs of seed per acre. The plough-furrow should not be more than 2 in. deep. Transplanting for gaps is not necessary; it is better to fill in with fresh seed. The crop is intercultivated with single, double, or 3-horse cultivators, the row between and round the plants being worked by hand. If manure is needed, a handful of guano to each clump of 3 seeds gives good results. If the best seed is saved by the grower, such as those showing the best keeping and feeding properties, the crop can be much improved.

A paddock of 17 acres contained the pumpkin crop, besides a 13-ton stack of lucerne hay, to which the sheep had free access. 1500 ewe hoggets were put in on the 14th June and were run 5 days on pumpkins and one day on grass till the 15th August — a total of 50 and 12 days respectively. When the sheep are first put in they eat all half-ripe and soft-skinned ones. After about a week it is necessary to commence splitting the harder pumpkins. Splitting for 1500 sheep takes about an hour a day. Hay is absolutely necessary for sheep on pumpkins.

172 – **Egyptian Sheep.** — *Bulletin of the Imperial Institute*, Vol. XIV, No. 2, pp. 282-284. London. April-June, 1916.

Although sheep-breeding cannot be said to be an important industry in Egypt, the animals occur in fair numbers in parts of the country. They are sometimes allowed to graze along the canal banks or are fed on Egyptian clover (*Trifolium alexandrinum*) and other crops, but the best are raised on the natural pastures in the north of the delta and along the Mariut coast-region. Considerable quantities of wool are exported, chiefly to the United Kingdom. In 1915 the total exports amounted to 72 73 cwts. valued at L. E. 255 273 = (£. 252 182 6 s.). There is also a considerable trade in Egyptian raw hides and skins, the value of the total exports in 1915 amounting to L. E. 167 519 (= £. 172 045 2 s.). of which L. E. 50 683 (= £. 52 055 8 s.) represented sheep and goat skins. Large quantities of tanned hides and skins are exported, the total value in 1915 amounting to L. E. 135 280 (= £. 135 629 8 s.) the value of tanned sheep and goat skins included in this total being L. E. 27 441 (= £. 28 184 2 s. 6 d.). The principal tanning material used is sant pods (*Acacia arabica*) the best of which are stated to be brought from the Sudan.

Three breeds of sheep are found in Upper Egypt, viz: **Saidi**, Ebeidi and Sanabawi. The first-named occurs most commonly in the district south of Assiut. It possesses long, silky wool, black or brown in colour as a rule, but occasionally white. The skin is thick and more in demand locally than any other for making leather for native shoes. The Ebeidi, which occurs in the district north of Assiut almost as far as Giza, is one of the most important kinds found in Egypt. The sheep in the region mentioned are better nourished than in other parts of the Upper Egypt and the meat of this breed is consequently much better than that of the Saidi. The wool is white, but it contains a high proportion of fat, which imparts a yellowish tint to the shorn wool; it is long and silky and samples of skin wool are said to have realised as much as 14½ d. per lb. at Liverpool. The Sanabawi, which is thought to be a cross between the Saidi and Ebeidi, is found in the neighbourhood of Sanabo in Assiut Province. The wool is fine and silky but rather weak; it is usually white, but sometimes reddish.

In Lower Egypt also three breeds occur. These are the Ooseemi or Merais, Fellahi and Rahmani. The Ooseemi is found pure in Giza, but it is largely used for breeding; crosses of this sheep with Rahmani and Ebeidi are found in different parts of the country, and it is said to be supplanting the latter breed in some parts. The wool is white and normally long stapled with a silky lustre, but that of the second shearing is shorter. First quality white skin wool of this breed is said to have been sold in Liverpool at 14 d.-17 d. per lb. The skins are of good quality, and are usually exported to Europe. The Fellahi is found commonly in the northern parts of Gharbia and Daqahlia, occurring in the Barari or waste lands in the whole north of the Delta. The pastures in this region are some of the best in Egypt, and there is a plentiful supply of berseem. These advantageous conditions of feeding render it possible for the Fellahi ewes to be milked for the manufacture of cheese and butter. The wool is similar to that of the Saidi.

being black, long and silky with a good deal of grease. A sample of skin wool of this breed was priced in Liverpool as 13¼ d. — 14 ¼ d. per lb. The Rahmani, originally imported from Syria, is found throughout the north of Beheira and Gharbia. The grazing ground here is good, and the Rahmani mutton is consequently of excellent quality, being brighter in appearance than that of the Ebeidi, but not so fat. The wool is long, usually red in colour, but occasionally dark brown or nearly black. It resembles mohair to some extent, being mostly free from grease and rather hairy in texture. The wools of this breed and of the Saidi are in good demand for the manufacture of native cloth, and are preferred for this purpose to the white wool furnished by some breeds. The skins are of good quality and are mostly exported to Europe.

A breed of sheep found in the Barqa district of Eastern Tripoli and known as the Darnawi, Gharbawi or Barquei, occurs along the Mariut coastline of North-west Egypt. These sheep are well fed and the ewes are milked, whilst the quality of the meat, especially that of the lambs, is excellent.

Sudanese sheep occasionally come into the Egyptian market. They can be recognized by their greater size and absence of true wool, their covering consisting merely of short hairs of no value. The skins, however, are of good quality, and are in demand for export.

173 - **Goat Raising in the States of Piauhy and Maranhão, Brazil.** — De Assis Iglesias Francisco, in *O Criador Paulista*, Year XI, No. 11, pp. 207-290, 8 fig. São Paulo, November 1916.

Notwithstanding the fact that the States of Piauhy and Maranhão are well adapted to goat raising on a large scale, the breeding of these animals is restricted to the small holders or colonists, each of whom keeps a little flock.

The animals are very mixed in character; it is, however, possible to distinguish among the varying types, 2 breeds which are in course of becoming fixed: 1) one of a light cinder colour, height a little above the normal, and a good fattening animal; 2) another, hornless, chestnut coloured, but with: the lower part of the body, the extremities of the limbs, the lower part of the tail, the escutcheon and face, black; the line of the back chestnut coloured but darker, the head well formed with straight profile. This latter is the so called " caninde ". race. The following measurements are given:

Live weight of adult animal	39 kg.
Length	65 cm.
Height to shoulder	56 cm.
» » sacrum	59 cm.
Length of ear	11 cm.

The writer records a goat which suckled 2 kids and gave in addition litre of milk a day, without receiving any special care. The litters are equently double or triple.

In the region under consideration, goats are not subject to any disease; their one enemy is the "onca" or jaguar (*Felis onca*). As a protection they are folded at night and in fact make their way to the fold themselves without any attention.

In 1913, the State of Piauhy exported 266 556 **goatskins**, valued at 273 452 726 *milreis*. Only the skins are exported; the meat is utilised on the spot for human or animal consumption, (for instance, boiled with the seeds of the Bengal bean (*Mucuna utilis*) they make an excellent feed for pigs).

174 – **Substitution of Potatoes by Mangels in the Fattening of Pigs; Experiments in Germany.** — RICHARDSEN, in *Deutsche Landwirtschaftliche Presse*, 43rd Year, No. 89 p. 715. Berlin, November 4, 1916.

The above experiments were carried out at the model farm of Dikopshof. Six animals were stable reared and subsequently given, as a trial experiment, in addition to a basal ration, as much roots as they could eat They developed more slowly than with a potato ration but quite normally At the age of 10 months the pigs were fattened off. The daily ration per 1 000 kg. live weight consisted of: 16 kg. barley, 35 kg. sugar beets, 3 kg. mangolds, 1 kg. fish-meal, 2 kg. blood-meal. This ration was changed every 3 weeks in proportion to the increase in live weight. Further, each pig was given 24 grams of chalk daily. The roots were cooked, cut up and mixed with the meal. They were taken with appetite, especially the mangels.

The fattening period lasted 63 days and gave the following results

	Increase in live weight per day
	—
1.	0.476 kg.
2.	0.571
3.	0.667
4.	0.579
5.	0.603
6.	0.587
Average	0.581

An average daily increase in live weight of 581 grams may be considered a good one, especially as the pigs were well fattened and gave excellent meat. It results that mangels may well be substituted for potatoes but fattening is rather slower.

FARM ENGINEERING.

175 – **Importation of Agricultural Machines and Implements into Russia from 1911 to 1912.** — *Сборникъ статистико-экономическихъ сведѣній по сельскому хозяйству Россіи и иностранныхъ государствъ* (*Summary of statistical and economic data relating to the agricultural industry in Russia and abroad*), Vol. V pp. 380-383. Petrograd, 1915.

The above publication of the Russian Department of Agriculture gives the data relating to the importation of agricultural machinery summarised in the following Tables (See Table, pages 280-283).

(1) For trade in agricultural machinery in Russia in 1911, 1912 and 1913, see: *B.* No. 562 — *B.* 1915, No. 949 — *B.* 1916, No. 1205. *(Ed.)*

176 - **A Double Plough for Disabled Soldiers.** — *Deutsche Landwirtschaftliche Presse*, Year 43, No. 102, pp. 832, 1 fig. Berlin, December 20, 1916.

The seat can be moved horizontally and vertically so that the disabled man can adapt the seat to suit him and guide the plough like a bicycle and regulate the working depth. To the right or left of the plough an adjustable support can be placed to support the injured limb of the worker.

Double Plough for Disabled Soldiers.

As the weight of the man rests entirely on the small furrow wheel the draught of the plough is little increased.

The seat is provided by this firm for all the double ploughs constructed by them.

The " Deutsche Landwirtschafts-Gesellschaft " (German agricultural Society) has given this plough the commendation : " new and remarkable ".

177 - **Aebi High Pressure Liquid Manure Pump** (1). — *La Terre Vaudoise*, 8th Year No. 45, pp. 363-364, 2 figs. Lausanne, Nov. 4, 1916.

The gravity system of distributing liquid manure over the fields of a farm by means of a conduit necessitates the placing of the farm buildings on the high land, which is not always practicable.

The new pump constructed by the firm of AEBI and Co., at Berthoud (Switzerland) allows of treating, with little trouble and small expense, land situated as high as 150 feet and even 300 feet above the farm house. The liquid is forced through a conduit into a reservoir situated on the high land. Connections too may be fixed at various levels to the main pipe, or on lateral branches. By attaching hempen tubes with nozzles it is possible to water several pieces of land in succession while the pump is at work. The reservoir may be filled by working the motor at any odd time and the liquid distributed by gravity.

The pump figured herewith is driven by a toothed gear run from fixed

See also ; *B.* 1912. Nos. 387 and 553 — *B.* 1913, No. 1075. (*Ed.*)

Importation of agricultural machines and implem

		Total annual imports	Ploughs	Steam ploughs	Harrows	Manure spreaders	Drills	Reapers and harvesters	Binders	Side-delivery harvesters
Total annual imports	1903	723 325	114 799	156	11 480	698	5 497	50 959	117 406	64
	1904	642 108	86 778	81	15 866	409	4 425	29 557	143 957	84
	1905	586 342	94 033	16	13 884	329	4 996	28 110	152 483	61
	1906	626 494	103 332	129	10 388	654	9 407	66 185	92 940	78
	1907	769 361	120 547	188	14 878	1 295	6 203	80 871	162 867	112
	1908	686 186	134 045	188	17 063	1 372	7 580	108 498	91 529	20
	1909	1 036 978	122 896	795	29 307	4 181	11 564	152 011	189 012	69
	1910	1 092 582	159 302	1 031	31 664	7 192	21 570	87 336	178 597	80
	1911	1 307 671	136 480	2 727	38 769	5 100	45 803	140 277	423 253	96
	1912	1 729 905	141 758	12 092	60 404	5 066	92 269	205 786	449 960	163
Principal countries of origin:										
Austria-Hungary	1903	53 505	8 390	—	21	25	998	24	384	
	1904	25 649	3 950	—	15	—	707	15	86	
	1905	54 800	28 513	—	36	30	1 321	11	266	
	1906	32 036	1 816	—	23	—	902	6	116	
	1907	42 425	8 418	—	372	255	2 004	4	289	
	1908	38 114	12 186	—	632	408	1 819	17	18	
	1909	42 797	11 691	—	101	873	3 287	7	22	
	1910	74 268	11 908	—	191	1 302	5 834	34	92	
	1911	70 266	9 538	—	933	527	6 208	—	132	
	1912	82 282	13 936	—	283	365	13 698	17	46	
Belgium	1903	116	21	—	—	—	2	10	—	
	1904	20	—	—	—	—	—	—	—	
	1905	244	64	—	—	—	123	—	—	
	1906	63	—	—	—	—	—	—	—	
	1907	14 498	—	—	—	—	—	—	14 498	
	1908	4 095	—	—	—	93	—	—	3 978	
	1909	134	—	—	—	—	—	—	—	
	1910	483	—	—	—	147	—	—	—	
	1911	92	—	—	—	—	—	—	—	
	1912	11 750	314	—	—	—	4	3 892	—	
Denmark	1903	16 507	96	—	1 978	39	75	2 002	4 661	
	1904	3 693	77	—	609	44	50	164	343	
	1905	2 988	24	—	10	—	—	13	1 496	
	1906	4 485	18	—	6	97	10	171	2	
	1907	14 832	53	—	150	221	43	4 175	2 664	
	1908	39 751	58	—	371	40	12	23 395	1 451	
	1909	64 806	63	56	2 946	159	153	15 221	39 492	
	1910	3 067	9	—	190	25	18	486	25	
	1911	4 868	86	—	293	87	21	190	1 923	
	1912	23 538	143	34	1 157	48	2 040	1 967	6 940	

Russia from 1903 *to* 1912 (*in metric tons*).

Threshers	Steam threshers with beater cylinders	Locomotives for threshers and ploughs	Winnowers and sorters	Graders for potatoes, etc.	Cylinder clover-hullers	Baling presses for hay, straw, flax, hemp, etc.	Chaff-cutters, etc.	Various agricultural machinery	Spraying apparatus, bellows and syringes for vines	Grape presses	Continuous grape presses	Churns and separators	Centrifugal separators and their parts	Machines and implements of recent invention for Agricultural Stations and Museums
19 397	91 617	114 966	10 917	1 091	1 729	720	8 110	44 665	352	199	832	991	4 778	9 589
20 973	73 633	90 165	7 851	147	935	614	7 033	36 729	583	195	185	879	3 709	2 667
10 510	65 175	80 209	6 730	80	276	1 366	6 150	40 511	360	8	284	971	5 608	1 942
15 085	87 535	54 311	7 491	148	1 141	390	6 109	39 289	166	8	319	982	7 673	15 744
23 797	45 363	70 824	10 368	358	3 603	528	7 361	77 980	479	12	681	1 436	6 656	9 878
27 324	68 858	104 158	9 623	710	13 525	1 413	9 918	111 942	453	97	303	1 599	9 723	1 791
34 227	104 409	144 930	17 185	1 098	6 589	3 864	10 894	136 692	926	83	223	1 422	9 312	1 994
33 695	117 299	147 253	17 257	1 174	3 558	2 254	13 954	160 125	1 974	133	330	1 672	10 982	5 351
34 589	111 743	140 639	21 234	1 178	4 372	5 507	5 507	271 518	1 043	64	103	1 868	10 225	6 383
5 533	9 749	9 981	4 682	7	107	101	2 699	9 728	9	—	—	3	3	—
3 919	2 294	2 637	2 076	5	46	2	2 325	7 467	26	1	1	17	8	—
3 973	3 090	5 128	3 470	19	16	41	1 891	7 122	13	3	—	33	11	—
3 832	5 855	6 308	4 231	35	—	7	2 376	2 864	1	—	40	9	37	418
5 251	6 084	6 870	3 909	—	16	2	2 627	6 117	8	—	—	9	131	1
6 296	1 821	2 866	4 578	6	324	87	2 682	4 811	7	1	68	26	16	—
5 257	2 322	3 210	5 238	1	303	123	2 044	5 046	1	—	—	2	72	36
8 969	10 117	11 801	7 196	12	349	104	3 206	11 320	39	7	—	31	17	—
11 [illegible]	7 139	7 008	8 522	5	166	20	4 890	13 238	26	—	—	17	99	2
9 [illegible]	3 059	6 538	11 078	2	118	316	5 618	10 571	—	—	2	5	55	65
	—	—	2	—	—	—	—	1	—	—	—	—	79	—
7	—	—	—	—	—	—	—	1	—	—	—	12	—	—
	—	—	—	—	—	—	—	18	—	—	—	—	39	—
	—	—	—	—	—	—	—	19	—	—	—	—	43	—
	—	70	45	—	—	—	—	124	—	—	—	9	—	—
	—	—	—	—	—	—	—	18	—	—	—	—	67	—
	—	—	—	—	—	—	—	53	—	—	—	—	55	25
	—	202	—	—	—	—	—	—	—	11	—	1	123	—
	—	—	—	—	—	—	—	—	—	—	—	—	92	—
94	—	—	—	—	44	—	—	3 250	—	—	—	—	—	—
55	206	197	—	—	—	—	20	1 001	2	—	—	257	818	1 055
46	—	—	—	—	20	—	7	1 290	—	—	—	116	630	67
3	—	—	3	—	—	—	7	405	1	—	—	186	606	101
	—	—	—	—	—	—	9	313	—	—	—	374	1 544	86
	115	118	—	—	80	—	113	210	—	—	—	603	1 313	—
13	—	—	13	—	—	—	7	1 786	—	—	—	668	724	42
	13	—	1	—	—	10	12	262	—	—	—	509	675	1 107
32	30	—	—	—	—	—	31	84	—	—	—	492	1 565	17
11	12	—	—	—	—	—	26	43	—	—	—	500	1 538	69
70	—	—	—	—	18	—	25	632	—	—	—	479	1 283	189

Importation of agricultural machines and implem

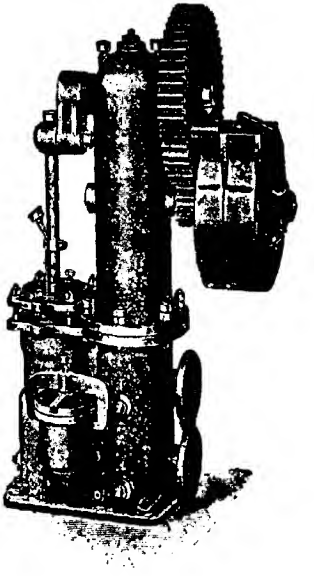
		Total annual imports	Ploughs	Steam ploughs	Harrows	Manure spreaders	Drills	Reapers and harvester	Binders	
Germany	1903	247 584	104 344	4	2 878	618	3 907	2 140	7 419	
	1904	244 440	79 978	—	3 433	365	2 998	3 143	16 283	1
	1905	186 125	62 970	16	2 755	383	3 130	1 302	21 750	
	1906	209 171	97 126	—	2 167	531	4 301	5 840	10 133	
	1907	260 795	104 865	129	7 078	797	3 634	11 563	15 978	1
	1908	334 636	114 365	34	7 149	758	3 904	30 000	47 093	
	1909	468 890	106 750	269	5 878	3 051	5 673	57 406	77 816	
	1910	407 070	144 813	382	4 565	4 389	6 781	4 293	16 544	
	1911	444 214	123 779	424	12 728	4 418	8 383	6 404	52 495	
	1912	608 861	117 653	863	17 307	4 567	12 213	18 393	74 366	
Sweden	1903	5 331	100	—	95	—	2	1		
	1904	3 965	329	—	433	—	—	46	56	
	1905	5 187	270	—	526	—	—	80	174	
	1906	5 839	371	—	295	—	—	137	—	
	1907	18 846	214	—	304	—	20	8 504	422	
	1908	25 018	229	—	728	62	112	12 429	942	
	1909	17 551	568	—	518	—	79	1 345	3 727	
	1910	46 425	531	—	1 886	2	515	16 092	1 648	
	1911	66 509	726	—	1 858	—	951	27 098	3 234	
	1912	52 781	294	—	510	—	2 374	16 324	1 883	
United Kingdom	1903	160 547	450	152	1 108	16	142	13 071	9 858	
	1904	123 098	853	—	4 092	—	18	6 819	6 164	
	1905	101 502	1 672	—	4 122	16	44	351	7 685	
	1906	70 774	318	48	3 130	6	48	3 120	7 656	
	1907	114 645	1 395	58	2 580	—	37	12 066	9 220	
	1908	110 497	2 371	—	2 544	10	98	4 191	18 736	
	1909	188 827	536	267	329	4	582	16 993	18 320	1
	1910	169 935	744	378	1 363	1 221	3 159	6 395	7 470	
	1911	214 829	1 192	444	3 286	36	2 202	728	23 611	
	1912	257 972	878	588	7 132	24	13 849	11 014	24 585	1
United States	1903	231 402	737	—	4 898	—	356	34 669	95 222	
	1904	239 064	1 278	21	7 270	—	651	10 330	120 120	
	1905	227 361	159	—	2 773	—	983	24 303	121 104	
	1906	297 075	348	23	2 496	9	4 135	56 656	75 026	
	1907	295 603	5 313	—	4 343	9	454	44 151	117 066	
	1908	130 639	4 205	137	5 394	—	1 645	38 382	18 518	
	1909	246 049	2 350	203	19 862	93	1 749	58 954	58 585	
	1910	385 317	422	271	23 398	104	5 257	60 033	150 350	
	1911	697 881	781	1 859	19 526	33	28 031	105 845	339 066	
	1912	671 776	7 152	10 607	32 667	63	48 022	52 697	334 125	

Russia from 1903 *to* 1912 *(in metric tons).*

Threshers	Steam threshers with beater cylinders	Locomotives for threshers and ploughs	Winnowers and sorters	Graders for potatoes etc.	Cylinder clover-hullers	Baling presses for hay, straw, flax, hemp etc.	Chaff-cutters etc.	Various agricultural machinery	Spraying apparatus, bellows and syringes for vines	Grape presses	Continuous grape presses	Churns and separators	Centrifugal separators and their parts	Machines and implements of recent invention for Agricultural Stations and Museums
15 813	27 546	39 406	6 635	1 069	1 089	340	3 424	23 185	105	58	289	317	1 003	1 082
14 049	33 231	39 951	5 611	136	683	495	2 961	22 299	117	175	50	423	1 369	2 352
4 774	22 248	29 365	3 116	60	166	1 133	2 855	26 159	105	5	141	564	2 707	484
10 002	19 989	20 961	2 972	113	1 039	164	2 017	24 439	7	8	247	477	2 872	310
10 211	16 939	19 596	5 739	355	639	531	2 916	37 792	176	18	262	459	1 531	507
10 105	17 793	23 802	5 664	349	3 052	427	3 922	48 899	174	4	349	484	1 844	231
9 617	22 863	37 731	4 350	709	8 655	619	5 498	89 675	256	97	257	468	2 576	520
12 292	37 475	48 340	8 864	1 061	2 490	1 343	5 650	92 788	585	63	211	522	2 950	405
13 430	38 354	48 888	8 155	1 117	979	1 036	5 412	104 908	439	97	123	607	4 529	1 167
10 579	43 305	53 622	7 259	1 137	2 083	2 347	5 437	168 361	470	21	103	940	3 785	1 294
135	948	1 073	—	—	—	—	44	54	—	—	—	447	2 601	1
59	39	1 261	—	—	—	—	6	308	—	—	—	114	1 248	—
47	843	848	—	—	—	—	24	129	—	—	—	129	1 994	1
14	367	1 211	—	—	—	—	3	324	—	—	—	46	2 686	—
37	1 429	1 455	—	—	—	—	33	96	—	—	—	188	5 543	—
112	930	1 368	—	—	—	1	48	765	—	—	—	161	3 703	—
303	543	1 754	—	—	947	—	30	676	—	—	—	117	4 039	87
1 046	3 070	5 179	12	—	2 342	—	136	1 368	—	—	—	215	3 589	10
231	2 752	3 891	3	—	—	—	39	2 495	—	—	145	229	4 063	145
612	416	758	9	—	—	48	47	5 232	—	—	—	179	3 935	29
3 579	50 340	63 485	78	15	465	279	1 608	4 211	—	—	111	76	79	134
2 322	37 554	46 039	53	6	123	—	1 689	3 122	—	—	—	72	341	47
1 634	33 462	43 037	52	—	95	180	1 965	3 878	9	—	—	31	68	271
1 105	21 497	24 247	241	—	223	71	1 514	5 905	86	—	—	53	9	10
4 700	22 338	31 636	59	7	186	—	1 948	4 154	49	—	—	135	45	342
6 631	24 641	41 124	46	—	181	—	1 184	3 847	6	—	—	56	36	5
5 162	41 600	58 299	13	1	3 613	205	1 274	6 620	—	—	—	46	260	7
7 419	52 411	74 266	431	25	1 313	34	1 128	6 702	141	—	—	115	594	981
9 305	67 441	81 956	25	41	2 092	29	2 283	11 796	95	—	6	162	131	3 373
9 381	62 322	76 088	1 360	35	1 378	528	7 712	15 527	82	—	—	70	197	145
930	2 057	655	11	—	68	—	165	4 481	45	—	—	79	—	6 412
414	153	199	—	—	64	115	44	2 166	196	—	—	122	52	200
255	5 789	698	7	—	—	5	154	2 018	80	—	—	25	24	1 084
590	39 430	934	19	—	379	61	160	2 770	33	—	—	17	20	14 421
643	508	3 155	24	—	—	13	50	12 945	7	—	—	14	—	1 307
267	477	1 532	32	3	46	13	90	16 884	148	—	—	36	102	9 600
635	1 456	2 938	—	—	7	540	1 005	9 188	152	—	—	400	3	9
618	1 183	3 561	641	—	92	2 340	700	23 339	90	—	—	24	5	582
1 020	1 490	4 116	522	10	321	1 152	388	26 469	98	—	—	17	12	597
1 515	1 439	2 631	1 431	—	712	2 224	1 136	58 670	15	—	—	17	24	4 663

and free pulleys and may be worked by the ordinary farm motor. A farmer who has installed one on his property estimates its capacity to be 44 gallons per minute with 3 HP motor and 1300 feet of 75 mm. tubing.

The AEBI pump would be useful for the direct distribution of liquid



A E B Liquid Manure Pump (*A B C*).

manure on uniformly level land or even for reaching higher land, and conjunction with a reservoir when the differences in level are more impo tant. It will considerably lighten the cost of carting and distributio especially on the higher parts of the property.

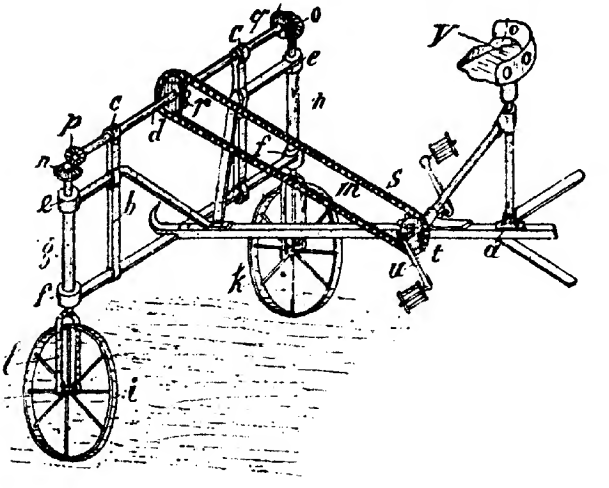
178 - **Guiding Mechanism for Seed Drills and Similar Machines.** — *Illustrierte Landwirtschaftliche Zeitung*, Year 36, No. 102, p. 676, 1 fig. Berlin, December 20, 1916.

This guiding mechanism made by V. RAÜBER (of Bernitt, Mecklenbourg) under German patent N° 290 239 (1) has the advantage of allowin the driver, placed on a seat, to use his hands solely for the reins and whi while he guides the machine with his feet.

As the figure shows the frame *b* fixed to the beam *a* carries both th

(1) See *B.* 1916, N° 1210, p. 1717.

uprights *c* supporting a horizontal bar *d* and also the uprights *e* and *f* for the vertical axles *g* and *h* of the guiding wheels *i* and *k*. The axles end in forks *l* and *n* on which the wheels *i* and *k* run ; they also bear on top the bevel gears *n* and o (arranged so as to obtain the same direction of rotation for both axles) which engage with the complementary gears mounted on



Guiding Mechanism for Seed Drills and Similar Machines.

the ends of the horizontal bar *d*. The latter is set in motion by a chain s driven from a gear wheel with pedals *u* below the driver's seat and worked by his feet. By turning the pedals the direction of the machine can be changed. Considering the lack of manual labour and the need for finding work for disabled soldiers, the machine is of interest.

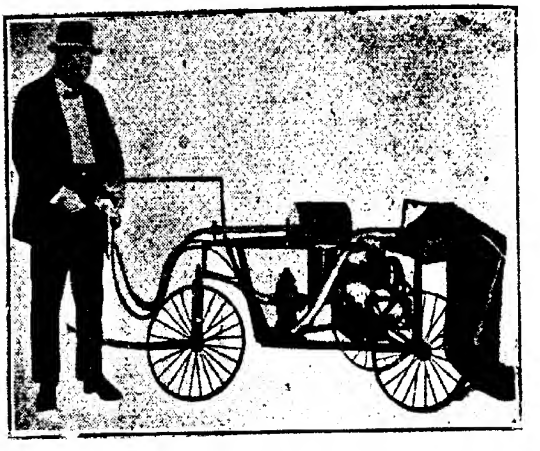
179- **A New Cotton Picking Machine.** — *Cotton and Cotton Oil News*, Memphis, Tenn. July, 21, 1916 ; reprinted in *Queensland Agricultural Journal* Vol. VI, Part 4, pp. 218-219, 1 fig. Brisbane, October, 1916.

This machine, constructed by the Southern Cotton Picker Company, Memphis, Tennessee, U.S., is certainly not complicated and it appears as easy of operation, as it is simple in construction. It does not pick with suction, but with brushes.

The picker head, which is driven by a flexible shaft, contains two bristle brushes that mesh together at a velocity of 400 revolutions a minute, a small toothed pin wheel combs the cotton from the brushes, which is then conveyed through a 1 $^1/_2$ inch tube into a container sack in the rear by suction, a small fan creating the vacuum behind the picker head which conveys the cotton into the sack.

The operator, after starting the engine, has nothing to do but apply the picker head with flexible tubes to each boll that is open, and instantly the cotton is deposited in the conveyor used for this purpose.

The picker head is protected against entry of any foreign matter or boll by a wire guard over its end just outside of the brushes, through which guards the brushes work, pulling the cotton into same, making is impossible for a boll to go through this guard, and nearly so for any section of a boll



Cotton Picking Machine of the «Southern Cotton Picker Company».

to enter the brushes. This system will not pick either dry or green leaves unless small particles of leaf should adhere to the back of cotton when it is picked.

It is made for one man to handle in the field.

Being constructed of iron, steel and aluminium, it is light and durable. It is driven by less than half a gallon of petrol for 12 hours. Even in unfavourable soil conditions the machine picks an average of 60 lbs cotton per hour.

180 - **Dust Aspirator for Chaff-cutters, Fendt System.** — *Deutsche Landwirtschaftliche Presse*, 43rd. Year, No. 98, pp. 776-797, 2 figs. Berlin, 6 Dec. 1916.

This apparatus, constructed by Theodor Fendt, at Markt-Oberdorf (Bavaria) and patented in Germany under the name of "Staubsauger" (dust aspirator) is placed on both sides of the hopper into which the cut straw falls.

The cutting apparatus is enclosed within a cage *a*, either with closed wooden or canvas sides fastened to the support *b* either permanently or in such a way as to be removeable at will. Within the guard, beneath

the point *c* where cutting is effected, there is placed on each side of the hopper *d*, a dust aspirator *f* separated from this latter by a sieve or grating *e*. These two aspirators are mounted upon a common axle *g*, driven by the axle *i* of the cutting wheel, the action being transmitted either by means of a cord, chain or belt.

The dust removed from the cut straw through the sieves *e* is eliminated from the apparatus by the ventilators (aspirators) *f*, which force it

Dust Aspirator for Chaff Cutters Fendt System.

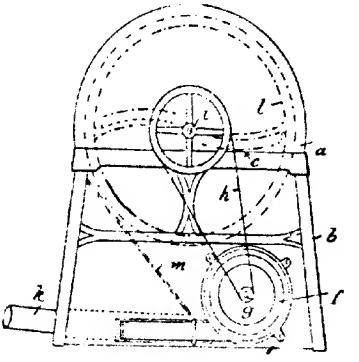


Fig. 1. — Side elevation.

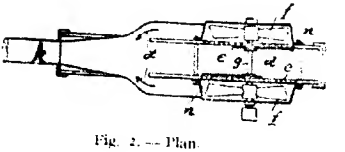


Fig. 2. — Plan.

long in the direction indicated by the two arrows (fig. 2), into the tube *k*.

The chute *m* within the cage facilitates the passage of the cut straw to the aspirators.

The sieves or gratings *e* of each aspirator may be kept clean by means of a revolving brush or by an arm *n* working sufficiently near them so as to clean them by friction or by air current or shock. The cage *a* may be provided with one or more doors enabling the sieves to be reached and cleaned by hand.

181 — Review of Patents.

Tillage Machines and Implements.

Canada	171 829 Weeder.
	171 952 Cultivator.
	171 971 Plough.
	172 066 Cultivator disc mountings.
	172 070 — 172 145 Harrows.
Denmark	21 621 Harrow with device for controlling the depth of the teeth.
	21 638 Device for lifting the shares of a motor plough.
France	480 821 Digging drum for agricultural implements.
	480 942 Motor plough.
	480 971 Tractor for agricultural use.
Netherlands	1 671 Motor plough.
United kingdom	12 191 Motor plough.
United States	1 200 107 Motor gang-plough.
	1 200 967 Weeder with bent teeth.
	1 201 296 — 1 201 649 — 1 201 950 — 1 202 563 — 1 203 104 Ploughs.
	1 201 398 — 1 201 399 — 1 201 982 — 1 202 394 — 1 203 643 — 1 204 257 Cultivators.
	1 201 547 Harrow.
	1 201 644 Gang plough.
	1 202 947 Tractor plough

Manures and Manure distributors

British India	2 639 Improved fertiliser.
	2 709 Process for obtaining from peat a product useful to agriculture and horticulture.
Canada	172 044 Manure loader.
France	480 647 A soluble and assimilable phosphatic manure and method for its manufacture.
Switzerland	74 005 Apparatus for spreading calcium cyanamide or other finely divided fertilisers.

Drills and Sowing Machines, etc.

United States	1 200 232 — 1 202 688 — 1 204 329 Sowers.
	1 201 065 Stalk Cutter.
	1 201 147 Potato planter.
	1 203 713 Sweet-potato digger.

Control of Diseases and Pests of Plants.

France	480 770 Spraying machine for cryptogamic diseases of the vine
United Kingdom	11 651 Spraying machines.

Reapers, Mowers and Harvesting Machines.

British India	2 654 Improvements in harvesters.
Canada	172 060 Bean Cutter.
United kingdom	12 503 Hay maker.
United States	1 200 455 Binding Mechanism.
	1 200 983 Sickledrive for harvesters.
	1 201 438 Traction-binder.

	1 201 508 Bean cutter.
	1 202 084 Lifting guard for Harvesters.
	1 203 954 Maize harvester.
	1 204 319 Attachment for grain-binders.
	1 204 328 Kafir-corn harvester and binder.

Machines for Lifting Root Crops.

enmark	21 631 Machine for lifting tubers and ro
nited States	1 201 280 — 1 203 345 Beet Harvesters.
	1 201 567 — 1 202 737 Potato Harvesters.
	1 203 713 Sweet-potato digger.

Threshing and Winnowing Machines.

ritish India	2 659 Paddy thresher.
anada	172 020 Grain Screen.
nited States	1 201 484 Attachment to Grain-separators.
	1 202 007 — 1 203 047 — 1 204 139 — 1 204 183 Grain-shocking machine.
	1 202 486 Green-Pea hulling machine.
	1 202 762 Threshing machine.
	1 203 760 Vibratory Straw-carrier.

Machines and Implements for the Preparation and Storage of Grain, Fodder, etc.

ritish India	2 668 Method and apparatus for preserving fruits, legumes, seeds, and other vegetable products
nada	171 706 Cutter for Grain Separators.
	171 864 Grain Elevator.
witzerland	74 220 Device for washing cereals
nited Kingdown	101 769 Portable Elevator.
nited States	1 201 376 Baling press.

Steering, etc. of agricultural machinery.

ance	480 971 Motor Tractor for agricultural use
nited States	1 201 432 — 1 202 015 — 1 203 364 — 1 203 783 — 1 204 290 Tractors.
	1 204 225 Self-propelled agricultural implement.

Feeding and Housing of Livestock.

nada	171 683 Animal release device.
witzerland	74 097 — 74 192 Pig troughs.
	74 098 Device for attaching a halter chain.
	74 191 Automatic water trough for cattle.

Aviculture.

ndia	171 734 Feeder for poultry.
ance	481 043 Improved brooder.
itzerland	74 099 Grinder for poultry food.
	74 124 Process for preserving eggs.
nited Kingdom	12 539 Poultry pen.

Apiculture.

enmark	21 654 Hive with movable independent shelves.

Dairying.

Canada	171 851	Teat cup.
Switzerland	74 122	Portable milking machine.
United kingdom	12 117	Milking machine.

Farm Buildings.

Canada	171 703	Fence Post.
	171 781	Stall for animals.
	171 846	Farm Gate.
	172 112	Windmill.

Various.

Canada	171 794	Peat Manufacture.
Netherlands	1 638	Process for making margarine.
United Kingdom	11 950	Steam cooker.
	12 283	Garden labels.
	12 482	Basket.

RURAL ECONOMICS.

182 – **Influence of Age on the Value of Dairy Cows and Farm Work Horses.** – McDOWELL, J. C. in *United States Department of Agriculture, Bulletin* No. 413 (Office of Farm Management), pp. 1-12. Washington, August 24, 1916.

The Office of Farm Management of the United States Department of Agriculture has published the results of the information it has obtained concerning the influence of age on the values of dairy cattle and farm work horses.

The dairy cows of each breed were divided into 4 classes, (see Table I) For each class of dairy cows of the Holstein, Guernsey, Jersey, and Ayrshire breeds the data presented in the percentage table (Table I) are given in graphic form.

All classes of live stock vary in actual value from time to time, but such variation does not greatly affect the relative value of the animal at different times. A cow worth $100 at 3 years of age, when there is a great demand for dairy cattle, will be worth less when there is smaller demand, but there will be a corresponding fluctuation in value for all ages. It is, therefore, believed that the percentage table will be found useful in determining relative value according to age. It is interesting to note some differences in prices owing to the distribution of the breeds. Thus, Holstein calves and old cows are valued relatively higher in the Central State than in the East. This is doubtless due largely to the lower price of feed in the North Central States. During their years of highest production, the price of Holstein cows appears to average a little higher in the Eastern States. This difference, however, is not marked, and in the cases of the $100 grade cow, it is reversed.

Guernsey calves and old cows, like those of the Holsteins, are cheaper in the East than in the central West. In the case of pure breds in their prime, however, the reverse is true.

TABLE I.—*Influence of Age on Value of Dairy Cows, Shown in Per Cent of Maximum Value.*

Age	Class I Grade cows worth $ 80 at 3 years of age				Class II Grade cows worth $ 100 at 3 years of age				Class III Purebred cows worth $ 200 at 3 years of age				Class IV Purebred cows worth $ 300 at 3 years of age			
	Holstein	Guernsey	Jersey	Ayrshire	Holstein	Guernsey	Jersey	Ayrshire	Holstein	Guernsey	Jersey	Ayrshire	Holstein	Guernsey	Jersey	Ayrshire
Birth	10 %	11 %	11 %	9 %	9 %	10 %	10 %	10 %	24 %	22 %	18 %	17 %	26 %	23 %	17 %	18 %
6 months	24	24	24	20	21	21	21	21	34	33	27	27	36	34	25	27
1 year	38	40	38	36	36	35	36	35	46	45	41	39	48	48	38	38
2 years	60	62	62	57	59	57	60	59	62	63	61	57	66	67	59	58
3 years	78	81	87	81	82	79	83	81	78	78	80	76	86	86	85	82
4 years	89	92	94	88	92	92	92	90	91	90	91	88	94	95	94	91
5 years	98	100	98	96	98	99	98	97	98	98	98	97	99	100	99	97
6 years	100	100	100	100	100	100	100	100	100	100	100	100	100	99	100	100
7 years	97	97	98	99	95	95	98	98	96	96	96	98	95	95	94	97
8 years	91	91	94	95	88	87	93	94	89	89	90	93	87	88	87	91
9 years	82	83	82	90	78	76	84	86	80	79	79	85	76	78	76	81
10 years	74	74	77	79	68	67	74	77	69	70	68	75	64	67	63	68
11 years	66	65	66	71	59	56	64	67	59	59	55	63	55	57	51	57
12 years	59	56	56	62	51	48	53	59	50	49	45	51	45	47	40	46
13 years	51	48	47	52	47	39	43	50	41	39	35	39	35	37	30	35
14 years	43	42	39	45	39	32	34	41	32	30	26	30	27	28	21	24
Number of estimates	107	101	144	137	159	103	134	141	114	70	137	79	148	115	96	59

Jersey calves are also relatively cheaper in the Northeastern States. Ayrshire calves and old cows are cheaper in the Northeastern States than in the North Central States, while Ayrshire cows, during their period of highest production, fetch a little higher prices than in the east.

The influence of age in the value of farm work horses is shown by Table II. The maximum value, $ 250, is reached at some point between 6 and 7 years of age.

TABLE II. — *Influence of Age on Value of Farm Work Horses: shown in % of Maximum Value.*

Age	Max. Value $ 250	Per cent of maximum value	Age	Max. Value $ 250	Per cent of maximum Value
		Per cent.			Per cent.
Birth	$ 39	16	9 years	227	91
6 months	63	25	10 years	209	84
1 year	96	38	11 years	190	76
2 years	142	57	12 years	174	70
3 years	185	74	13 years	154	62
4 years	220	88	14 years	137	55
5 years	242	97	15 years	119	48
6 years	248	99	16 years	101	40
Maximum	250	100			
7 years	241	99	Number of estimates	147	—

As is seen, there is little change in value between the ages of 5 and 9.

AGRICULTURAL INDUSTRIES.

183 - **Practical Method for Removing the Foxy Flavour from Noah Grapes** (1). — TISSEDRE, L., in *Le Progrès agricole et horticole*, 33rd. Year, No. 45, pp. 442-443. Montpellier, Nov. 5, 1916.

The writer possesses some Noah grape stocks all derived from 2 cuttings found in 1883, in a consignment of plants from Missouri, U. S. A. The following are the chief characters: wood, red, stout, very long, rough to the touch, similar to the York-Madeira — internodes at an average distance apart — leaves enormous and sea-green in colour — grapes above average size with very big seeds — clusters dense, often winged — taste strawberry flavoured but not too pronounced. Grows well from cuttings.

(1) See also *B.* 1916, No. 555.

For the last 4 years the writer has used the following method for obaining wine without fox: The grape juice after leaving the press is placd in fermenting casks. These casks were never completely filled: a space arying from 5 to 10 cms was always left. A hole is then drilled in the ottom of the cask at the level of the liquid so as to establish an air-curent with the open bung-hole: the liquid was then allowed to ferment. The elimination of the foxy flavour takes place automatically and when ermentation is completed the wine is devoid of any appreciable Amejican flavour and may be placed on the market.

In a note accompanying the present article Prof. L. RAVAZ remarks at if *one* drill-hole already gives such a satisfactory result then the result drilling *two* holes should be better still. The disappearance (or attenuion) of the odours causing the "foxy" flavour during the process under dice is possibly due to accompanying oxidisation phenomena.

4 - **Compulsory Degerming of Maize in Hungary** (1). — KÖZTELEK, Year 26, No. 45, pp. 1485-1590. Budapest, Nov. 4, 1916.

A Governement Order dated Nov. 1, 1916 imposes obligatory removal f the germs from maize grains and gives the rules to be adopted for effectg the same. The order further contains measures for regulating the ade in maize germs, extraction of oil, sale and maximum prices. Acording to the provisions of this order all stone mills and establishments r the milling of maize are obliged to remove the germs and to carry all perations according to the instructions of the "National Union of Credit". The mills may not extract more than 12 lbs. of germs per 100 lbs. f maize, and the quantity of oil expressed must be at least 15 lbs. per 100 s. of germs. This order only concerns stone mills, especially those which, hanks to the aid of the above mentioned Union are in a position to comlete the alterations which the Union requires for the process in question.

Every holder of maize must inform the "National Union of Credit" writing of the amount of stock he holds. Stone mills and other establishents for milling maize are obliged to signal the quantity of germs proced, twice a month, *viz*: on the 5th and 20th days at latest and to make special declaration whenever the quantity produced reaches 100 quintals (7 cwt.). In this connection the Union has the power to hold the esta ishments in question under permanent supervision (art. 2).

The stocks of maize of which the returns have been made are to be ized immediately the present order comes into force, and the supplies of rms may be sold by the owners solely to the said Union. In this way e Union on behalf of the Treasury, becomes the sole holder of the stocks maize germs throughout the whole of Hungary (art. 4).

For the stocks of germs, the samples of which when examined by y designated Chemical Station must contain at least 15 % of oil, the ve Union undertakes to pay the following prices per kilo (2.2 lbs) 62 *ler* (6 1/4 *d.*) to all commercial establishments and any other enterprises luding those for the fattening of live-stock not attached to farms:

(1) See also: *B.* 1916, No. 1017. (*Ed.*)

102 *heller* (10 ¼ *d.*) to millers who degerm the maize of the producers required by these latter for the use of their families, servants and farm generally. This price includes carting to the place of unloading but not the cost of the sack. If the oil content exceeds 15 %, the price paid must be 1 *heller* ($^1/_{10}$ th. of a penny) for every unit of percentage in excess; on the other hand, for every unit of percentage short of this standard 2 *hellers* shall be deducted.

All mills and such other establishments already mentioned are obliged to degerm the maize of the grower, with or without his consent even when required for personal use on his farm, but he shall be entitled to an indemnity on the following scale :

1) Milling of the degermed maize shall be gratis.

2) In exchange for the germs extracted the aforesaid mills and establishments shall pay a sum equivalent to the value of an equal quantity of maize viz 3 *kronen* per quintal (1s. 3*d.* per cwt) (2).

3) Further the said mills shall pay the producers an indemnity of : 3 *kronen* per quintal of treated maize (art. 7).

The transport of maize by rail, water or motor is not permissible without a special certificate issued by the " National Union of Credit " art. (8).

The said Union distributes the stocks of germs declared by the mills among manufacturers possessing the necessary plant for the extraction of oil (art. 9).

These factories receive, per 15 %, of oil expressed, 18 kronen per quintal (7 s. 7 *d.* per cwt) of germs (art. 10).

In virtue of the present Order, all oil stocks are requisitioned and manufacturers are obliged to hand over the oil they produce to the Union, which in its turn will re-sell it to the Central Hungarian Society of Fats and Oils at the price of 1000 kronen per quintal (1) (£ 21. 3s. 4*d*) (art. 11,12 and 13).

This Limited Society is concerned with the marketing of the oil and is authorised to demand, over and above the price paid to the Union of Credit, a share of profit fixed by the Minister of Commerce. The retail selling prices are also fixed by the same Minister (art. 14 and 15).

Infringements entail severe punishment and a fine not exceeding 200 kronen (£ 8.3. 6s 8*d*) may be inflicted. Stocks held up or undeclared are seized by the authorities. This Order comes into vigour the 1st November 1916 (art. 16-21).

The obligation to remove the germs from maize can only be imposed on growers who send their produce to mills or factories for this purpose. When they do so, however, they have the right to claim an indemnity as mentioned above.

185 - **New Process for Extracting the Oil from the Kernels of Stone Fruit.** — Abstract in *Chemiker Zeitung*, 40th. Year, No. 91-92. pp. 645-646. Cöthen, 1916.

According to the census of 1900, Germany possesses 21.5 millions of cherry trees and 69.4 millions of plum trees. According to statistics

(2) All conversions of Austrian money in this article are based on par value. — *Ed.*

on this subject and to the calculations of the writer, the cherries give 5 %, the plums and apricots 10 % of stones. The stones of cherries give about 30 % of kernels, those of prunes 15 %, and those of peaches about 7 %; the kernels of cherries contain 36 % of oil, those of plums 42 %, those of apricots and peaches 47 %. These figures only apply to good, picked kernels, the actual total yield of oil would be less but it is permissible to assume that in Germany, in good years, several millions of pounds of oil might be extracted from the kernels of stone fruit. Unfortunately, this source of oil is not exploited in Germany owing to the lack of good machinery for crushing the stones and because the separation of the kernel involves considerable trouble. Recently, the firm of MARTIN of Bitterfeld has constructed a machine which crushes the stones extremely well. For separating the kernel from its shell the writer has discovered a method based on the specific gravity of these two portions. The sp. gr. of plum kernels is about 1.05, that of their shells 1.18. For cherries, apricots and peaches, the ratio between the sp. gr. of the kernel and that of the shell is about the same. By using a magnesium chloride solution with sp. gr. equal to 1.15 the two portions may be separated with ease. The kernels float the solution while the stones fall to the bottom. The kernels are then dried, stripped and pressed.

The method is well adapted for large quantities of stones. The writer has experimented chiefly on plum stones but trials with those of peach and cherry were equally satisfactory.

The oil obtained produced no hydrocyanic acid; it was slightly turbid at first but gradually cleared. The taste from being pleasant at first, gradually became somewhat bitter, strongly resembling that of the oil from bitter almonds. It does extremely well as salad oil. Heated to 160° C. or kept for 2 weeks in an open bottle, it lost its characteristic odour.

The method is being perfected.

6- **Some New Constituents of Milk. The Distribution of Phosphatides in Milk.** — OSBORNE, THOMAS B. and WAKEMAN, ALFRED J., in *The Journal of Biological Chemistry*, Vol. XXVIII, No. 1, pp. 1-9. Baltimore, Md., December, 1916.

In a preceeding paper (*The Journal of Biological Chemistry*, Vol. XXI page 539. 1915)the writers have shown that the alcoholic washings of the coagulated protein obtained by boiling the filtrate from casein of cow's milk yield to alcohol a small quantity of monoamino- and diaminophosphatides. They have now examined the alcoholic washings of casein and have found that these likewise contain a small amount of similar, if not identical, phosphatides. They have also extended their investigation to the other parts of milk in order to learn as much as possible about the distribution of phosphatides in milk.

The results of this examination have lead to the following conclusions:

Alcohol removes from milk casein, precipitated by diluted hydrochloric acid about the same amount of phosphatides as was previously obtained from the " lactalbumin ", the proportion of phosphatide which it yields is correspondingly less.

The precipitate produced by treating skimmed milk, freed from case and heat-coagulable proteins, with sodium hydroxide until neutral to ph nolphthalein contains a very small amount of the same phosphatides an fatty substances that can be obtained from the alcoholic washings of th heat-coagulable proteins (« lactalbumin »). The non-protein fractions fat-free milk contain at the most only minute traces of phosphatides. Th total amount of phosphatides obtained from 1 litre of whole milk was equa to about 27 mgms.

Phosphatides are intimately associated with the protein constituent of milk and possibly are combined with them as " lecithalbumins ".

187 - **The Dairying Industry of England and Wales.** — GAVIN, W. and MACKINTOSH, J. *The Journal of the Board of Agriculture*, Vol. XXIII, No. 6, pp. 593-597. London, September 1916.

Supplement No. 16 of the present number of the Journal of the Board Agriculture contains two papers which, together, constitute a valuable s vey of the dairying industry in England and Wales.

The first paper, by W. GAVIN, opens with an historical survey of dairying industry in the last half century, and draws attention to the rapi increasing volume of the fresh milk trade.

The number of cows and heifers in England and Wales increased fr 1 952 648 head in 1881-1885 to 2 484 220 head in 1914; an increase of so 30 per cent., as against an increase in the population of the country of per cent since 1871.

The greatest increase in dairying has occurred in dairying distric

The author next deals with the railway milk traffic of the various r way companies, with special reference to the London milk trade. The fig obtained for the total railway milk traffic of London is 91 700 000 gal and this, added to a road traffic of 15 000 000 galls and the produce of Lond dairies — 1 200 000 galls — gives the total milk supply of London as appro imately 108 000 000 gal.

The midland towns of Lancashire, Cheshire, Warwick, Stafford and t West Riding take something over 50 000 000 galls the North-East Coast tak 11 000 000 galls., the South Wales mining area 4 000 000 galls, the Sou East Coast and district 4 500 000 galls and the South Coast 5 750 000 galls

With 92 000 000 galls. taken to London and 100 000 000 galls el-ewhe the total handled by English railways does not exceed 200 000 000 gall

The total consumption of milk was estimated as 731 000 000 galls in 19 so that about one quarter of the milk consumed in England and W is transported by railway.

Many consignments are made from great distances; in 1911 the G. W brought 1549 churns from St. Erth, Cornwall, 320 miles to London, while most distant point recorded by the L. & N. W. R. for London milk traff Toom (Ireland) 513 miles from Euston Station. A valuable summary the railway traffic is given in an appendix in which the principal consum and producing areas of the various lines are shown, where possible.

The share taken in the industry by the various countries, and the c ditions obtaining in these countries are next considered. It is emphas

Class	Per Gallon of Milk			Per 100 lb of Milk			Per 1 lb of Butter-Fat		
	I	II	III	I	II	III	I	II	III
	d.	d.	d.	d.	d.	d.	d.	d.	d.
Value of Manurial Residue and Gross and Net Cost of Food.									
1. Gross Cost of Food	4.83	3.72	4.14	46.89	36.11	40.19	12.34	9.50	10.58
2. Value of Manurial Residue	0.35	0.26	0.38	3.40	2.52	3.69	0.90	0.66	0.97
3. Net Cost of Food	4.48	3.46	3.76	43.49	33.59	36.50	11.44	8.84	9.61
Summary of Overhead Charges.									
4. Labour	1.60	1.30	1.42	15.53	12.62	13.78	4.09	3.32	3.62
5. Depreciation and Loss	1.47	0.37	0.73	14.27	3.59	7.09	3.75	0.94	1.86
6. Interest on Capital	0.42	0.36	0.39	4.07	3.49	3.78	1.07	0.92	1.00
7. Depreciation of Dairy Utensils and Food Machinery; Oil and Coal, Veterinary Charges, Medicines and Sundries	0.37	0.31	0.36	3.59	3.01	3.49	0.94	0.79	0.92
8. Keep of Bull	0.22	0.18	0.20	2.13	1.74	1.94	0.56	0.46	0.51
Total	4.08	2.52	3.10	39.59	24.45	30.08	10.41	3.43	7.91
Summary of Transit Charges.									
9. Keep and Depreciation of Milk Cob, Upkeep of Milk Cart, Railway Churns etc.	0.21	0.44	0.42	2.04	4.27	4.08	0.54	1.12	1.07
10. Railway Carriage	—	1.04	0.78	—	10.10	7.57	—	2.66	1.99
Total	0.21	1.48	1.20	2.04	14.37	11.65	0.54	3.78	3.06
Cost of production to the farmer	8.78	7.46	8.06	85.12	72.41	78.23	22.39	16.05	20.58

) that the basis of dairying in England and Wales is now the fresh milk rade ; 2) that cheese-making, though still carried on in some districts, is nerally speaking, only continued (*a*) in districts where lack of transport ncourages it, or (*b*) as a means of utilising a surplus or flush of milk when rices are low; 3) that butter making, with the exception of that in the ornish factories, is a rapidly diminishing industry in England and Wales.

On the basis of the figures given in the Board's report on the agricultural utput of Great Britain, the total milk production of England and Wales placed at 1 071 000 000 galls. With regard to the consumption of milk, at for the whole of England and Wales is placed at 22 ¼ galls, and that r London as 15 galls. per head. The paper concludes with a survey of the nports and exports of dairy produce.

The second paper, by J. MACKINTOSH, deals with the average costs, not erely of food in the production of milk, but also of various overhead charg- and transit charges, the former including charges in respect of labour,

depreciation (on live and dead stock) interest on capital and keep of bull and in connection with the cost of food due attention has been paid to the value of the manurial residues of the foods consumed. The farms to which the investigation related were situated throughout the county of Bucks and in parts of the counties of Berks, Oxford and Middlesex.

The costs are given for three different types of farms : Class I - Suburban farms ; Class II — Farms almost entirely grass land with very little arable ; Class III — farms chiefly grass land, but with a fair acreage of arable.

The following table shows for the three types of farms, the gross cost of food, the value of the manurial residue, the net cost of food, the overhead and the transit charges :

The division of the gross cost of food between the various kinds of foods is as follows :

	Roots	Hay	Straw	Wet Grains	Cakes & Meals	Pasture & Aftermath
	%	%	%	%	%	%
Class I	17,8	13,4	7,6	12,5	36,3	12,4
Class II	12,5	23,2	6,2	—	35,0	23,1
Class III	16,6	15,5	6,2	—	45,2	16,5

The average yields per cow were : from farms in Class I. 650 galls Class II. 640 galls; Class III. 660 galls In working out the above costs no charge was made for the supervision by the farmer or bailiffs. The paper concludes with a brief summary of the results obtained by other investigators. These figures, based on a small areas under the war conditions, cannot be regarded as of universal application, but are useful in supplying farmers with a method by which they can work out their own costs, and thus examine their practice closely where they find their costs exceeding the average figure given in the paper.

188 - **The Trade in Feathers in Brazil.** — REDONDO, A., in *Broteria, Serie de Vulgarisação Scientifica*, Vol. XV, Fasc. 1, pp. 33-35. Braga, January 1917.

Among the feathers exported from Brazil there figure in the official lists : 1) those of "garça real" (*Ardea egretta*), "garça pequena" (*Ardea candidissima*) and "garça de cabeça preta" (*Nicticorax pileatus*) ; 2) those of "ema" (*Rhea americana*) ; among unspecified kinds occur those of "guarás" (*Endocimus ruber*) with red plumage ; "colhereira" (*Ajaia Ajaja*) with plumage of a delicate rose colour, and many others.

The most highly valued feathers are those of "garça" ; they are exported chiefly from the Southern States of the Brazilian Union: Pará, Amazones, Maranhão, Piauhy. Those of "ema", chiefly employed for the manufacture of boas are mostly exported from the States of : Bahia, Piauhy, Maranhão, Ceará and Rio Grande do Sul. The "guará" are found in abundance in the Northern States and especially in the region of Amazones, Pará and Maranhão.

The importing countries are, in order of importance : United States - France - Uruguay — England — Germany.

The appended Table gives the quantity and value of the export of feathers for the period 1910-1914.

Exportation of feathers from Brazil during the 5 year period 1910-1914.

Year	« Ema »		« Garça »		Not specified	
	Quantity	Value *	Quantity	Value *	Quantity	Value *
1910	3 893 kg	50 175 fr	126.292 kg	143 517 fr	571 kg	20 924 fr
1911	1 907	26 141	223.413	141 471	93	1 781
1912	5 249.5	80 185	78.500	70 405	14.24	3 548
1913	4 613	66 862	248.788	147 813	84.60	2 271
1914	3 069.5	47 789	120.968	108 155	28.50	2 352

* The paper *milreis* has been taken as equal to 1.68 fr.

The trade in feathers is of a very precarious nature and is subject to considerable fluctuations from one year to another; taken as a whole it is at present on the wane, for the export value in 1914 was only 158 296 fr. against 223.849 fr. in 1904.

PLANT DISEASES

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

189 - **Tuberoid Deformities on Sunflower Roots in Italy.** — BÉGUINOT AUGUSTO, in *Atti e Memorie della R. Accademia di Scienze, Lettere e Arti in Padova*, Vol. XXXII, Part III, pp. 229-242. Fig. I-II. Padua 1916.

In November 1914, the Author received from Porto Tolle (Venezia) some roots of *Helianthus annuus*, which showed many swellings presenting two widely different forms, even after microscopical examination.

The second form of swelling was only to be found on the secondary underground roots it was cylindroid, rarely oval or irregular, varying from 1-2 mm. up to 3 mm. in diameter ; the deformities were placed along the axis of the root, less often on the tip, isolated or clustered ; in some cases, the whole of a short root was deformed ; then the swelling was longer, more bulky and because of the other roots, often irregular; these swellings were rather flabby ; but the best developed ones resisted compression slightly, and appeared somewhat hardened. According to the size of the swellings they contained one or several females of a nematode belonging to the genus *Heterodera*, but which differed from *Het. radicicola* and *Het. schachtii*.

The writer has seen on material from Porto Tolle another deformity that appeared different from the previous one, both on naked eye and microscopical examination. It consists of larger swellings, of an average diameter of 3 to 6 mm. and a maximum diameter of 18 to 20 mm., placed at the tips of the roots, pyriform, less often rounded, never cylindrical, and quite woody in consistency. No nematode as observed in the first form nor other parasites were seen in the woody and largely vascularised tissues in the swellings. A large number of individuals of a species of *Rhabditis* (fam. *Anguillulidae*) were found adhering to the cortical parenchyma already investing the woody body and decomposing.

In order to ascertain if the cause of the second type of deformity has anything to do with the previous nematode, cultures of *Helianthus annuus* were started in the Botanical Garden of Padua, using seeds from

Porto Tolle. Control plants were chosen and the remainder were subjected to various traumatic actions (torsion, flexion, various wounds, defoliation, topping at various stages of development, etc.). Topping the plants resulted in a large series of morphological and anatomical deviations which are not described, as they more or less agree with those already obtained and illustrated by VÖCHTING, before him by KRAUS, WOLLNY and BERTHOLD. In some of the *Helianthus* plants grown at Padua and topped, the author observed, towards the end of October 1915, the presence of both hypogean and epigean tuberoid deformities; the latter which were absent for the Porto Tolle material had already ben observed by VÖCHTING. As regards the hypogean swellings, the zone deformed (end of the roots), he average size, the form and woodiness of the plants obtained at Pa-ua in topped plants agreed with the corresponding characters shown y the Porto Tolle material. No similar deformities were seen in the ontrol plants or in other plants which had been submitted to traumat-sms other than topping during the vegetative period. The deformities vere only found in some of the plants that had been topped.

No *Heterodera* was ever found in the sunflowers grown in the Padua Botanic Garden, no matter what the type of deformity was, if similar to that in the Porto Tolle material, although *H. radicicola* had already been recorded as living on various plants growing in the same garden; on the other hand the decaying adult bark did not harbour the other nematode (*Rhabditis*) which was, on the contrary, very abundant in the original material. As Helianthus was grown at Padua on a sufficiently large scale, the absence of *H. radicicola* shows that *Helianthus annuus* is not attacked by this nematode, and that where it is attacked, it probably is a different species or race. In addition the complete absence of eel worms shows hat there is a different cause of the tuberised roots and further it is robable that the *Rhabditis* found in the Porto Tolle material should not e considered as a parasite.

The author concludes from his researches and observations that the eformity he has described can not be ascribed to a parasitic agent, and hat it is difficult to regard the nutritive disturbance caused by topping s having no connection with the cause. Under natural conditions, mutiation and wounds caused by wind, hail, etc., are not rare; possibly the lants at Porto Tolle had suffered in this way.

Nevertheless, the writer is aware that his theory does not explain the ct that all the topped sunflowers did not show the same reaction and hy the tuberoid deformity is not caused by traumatisms other than opping.

o-**On a Disease of the Banana in the Saleyer Islands, Indian Archipelago.** — RIJKSS, A. B., in *Mededeelingen van het Laboratorium voor Plantenziekten*, No. 21,16 pp., 1 Map, 6 Figs. Batavia, 1916.

A study of a disease that has devastated the banana plantations in me islands to the south of Celebes for some ten years. The disease is own by an internal rot of the subterranean parts, which afterwards at-

tacks the flowering stem, and then the fruits, which show no external sign of disease for some time.

The dark red colour of the underground parts as seen on cutting them is characteristic of the disease. The leaves remain normal for some time but are attacked finally and the plant falls over.

The writer has found that the disease is very infectious and is spreading more and more in the surrounding islands. As certain varieties appear to be immune, it is advised to grow them and at the same time to rigorously prevent the passage of infected material into other countries.

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

191 - **Fungi in the San Martino Valley (or Germanasca Valley), Piedmont, Italy.** — PEYRONEL, BENIAMINO, in *Memorie della Reale Accademia delle Scienze di Torino, Classe di Scienze fisiche, matematiche e naturali*, Series II, Vol. LXVI, No. 10, pp. 1-58, Figs 1-1 Turin, 1916.

This first systematic list of the fungi of the Valley of San Martino a contribution to the study of the flora of the Vaudois valleys in Piedmont which up to now is slightly known through the publications of FAVO and FERRARIS. The list icludes 362 species, varieties or forms of the tru Fungi, together with 4 species of Myxomycetes.

With the idea of obtaining material for future study of the problem inherant to the biology of alpine mycological flora, the Author has no studied the whole of the Germanasca valley, but has limited himself to careful study of a limited portion (districts of Riclaretto, Faetto an Prali) of the valley from 1911 to 1914.

Recorded as new to science are 3 genera, 14 species, and one for There are also many fungi new to Italy, or interesting from other point of view.

192 - **Research work in the Laboratories of Agricultural Mycology and Entomolo in the Belgian Congo.** — See pp. 178-179 of this *Bulletin*.

193 - **New *Uredinaceae* in East Africa.** — GROVE, W. B., in *Royal Botanic Garde Kew, Bulletin of Miscellaneous Information*, No. 10, pp. 269-272, 5 fig. London, 1916.

Systematic description of:

(1) *Uromyces Polygalae* Grove, on leaves of *Polygala persicariaefol* D. C., or a related species, in Uganda (Kipaya 4000 ft.) March 1916 the sori were infected with many pycnidia of *Darbuca filum* Cast;

(2) *Puccinia Erlangeae* Grove, on leaves of *Erlangea tomentosa* Moore, in British East Africa (Nairobi, Limoru 4000 ft.), February 191

(3) *P. exilis* Syd. var. *Hibisci* Grove, on leaves of *Hibiscus* sp., Uganda (Kirerema 4000 ft.), March 1915;

(4) *P. Hoslundiae* Grove, on leaves of *Hoslundia* sp., in Ugand (Kipaya 4000 ft.), March 1915;

(5) *P. necopina* Grove, on leaves of Tristemma sp., in Uganda (Kiayo, 4000 ft.), March 1915;

(6) *P. pentadicola* Grove on leaves of *Pentas verticillata* K. Schum. var. *pubescens* S. Moore in Uganda (Mubango 4000 ft.), January 1915.

94 - **Comparative Tests of Remedies against Vine Mildew (*Plasmopara viticola*), in Austria in 1916.** — KORNAUTH, K. and WÖBER, R., in *Allgemeine Weinzeitung*, Year 33, No. 45, pp. 363-365; No. 46, pp. 371-374. Vienna, November 9 and 16, 1916.

As in the previous year, the Imperial Station at Vienna for the protection of plants has collaborated with the Austrian Wine-growers' Association in conducting comparative tests of sprays with and without sulphur, during the vegetative period, in order to determine their efficiency in controlling vine mildew. Trial plots belonging to the Imperial Station were utilised as well as the vineyards belonging to the provincial Schools of Feldsberg and Mistelbach and also to a private proprietor at Guldenfurth (Moravia).

The remedies used were:

I. — *Preparations using copper as a basis.* — Bordeaux mixture of various strengths; Burgundy mixture; " Bosna " copper paste of various strengths.

II. — *Copper sprays mixed with other preparations.* — Martini formula modified by the Imperial Agricultural Experiment Station at Gorizia; Bordeaux mixture with aluminium sulphate added; copper spray together with " Perozid ", copper sulphur lime mixture.

III. — *Sprays without copper.* — " Perozid " in different strength; " Perfluozid I "; " Perfluozid II "; " Zinkpasta "; " Melior "; " Cumullit "; sulphur lime mixture; " Asra ".

The " Bosna " copper spray contains 17.04 % Cu.; 16.98 % Cl.; 36 % Ca. and 44.7 % water. (The makers guarantee a content of 16.6 % copper).

The aluminium sulphate used in preparing the Bordeaux mixture together with aluminium sulphate, is simply commercial aluminium sulphate mixed with iron sulphate.

" Perfluozid I " is an acid fluoride of zinc, while Perfluozid II is a compound of sodium fluoride and fluosilicic acid.

" Zinkpasta " contains 9.23 % of zinc, and also hydrochloric acid, calcium and water.

The active constituent of " Melior " is parachlormetacresol; it also contains alum and soda. " Cumullit " also contains parachlormetacresol.

" Asra " contains β - napthol.

The copper mixtures are prepared in the usual manner, while the solutions from the new preparations are made according to the instructions of the makers.

The only difficulties have been dissolving " Melior " and " Cumullit " and mixing " Zinkpasta " in a state of fine division with water.

The mildew was very prevalent both on the leaves and grapes in Austria during the year of experiments. The following are the conclusions arrived at by the writers:

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(1) See also *B.* August 1915, No. 793

(*Ed.*)

1) The different sprays tested were sufficiently adherent in practice and did not damage the leaves.

2) Spraying with a 1 % copper spray does not give sufficient protection, especially for the grape, when the mildew is so extensive and early as in 1916. Only the stronger sprays (2 % Bordeaux mixture or 2 % " Bosna " cupric paste), applied 4 times, have preserved the leaves and grapes in a satisfactory condition.

3) The copper sprays with a varied proportion of lime which did best are those using 500 grm. of quicklime, thus about double the calculated amount of CaO for 1 kg. of copper sulphate.

4) The so-called Burgundy mixtures which have 1400 grm of crystal sodium carbonate to 1 kg of copper sulphate, do not injure the leaves though they have been said to do so. The injuries observed by other writers are due to different causes and should not be blamed on the soda. A 1 per cent. Burgundy mixture was found to be more successful in these tests than 1 % Bordeaux mixture.

5) The " Bosna " copper paste acted very well, especially in preserving the grapes. The 1 per cent. mixture of this paste was found to be equal to 1 per cent Bordeaux mixture, even though " Bosna " only contained 17 % of metallic copper as compared with 25.4 % in copper sulphate. The defect that mixtures with " Bosna " paste deposit easily does not decrease its practical value, as the movement of the workmen keeps it sufficiently stirred up.

6) Economising copper sulphate by adding alum (as in the Martini mixture) or " Bodolidat " resulted in the observation that Martini sprays only containing about ½ % of copper sulphate are less efficacious than ½ % burgundy mixture. On the other hand they preserve the foliage better than the sprays containing " Perozid ".

7) A ½ per cent. Bordeaux mixture to which ½ per cent. of " Perozid " had been added acted better than Martini mixture containing ½ % copper sulphate; the effect was not equal to that obtained by a 1 % Bordeaux mixture. On adding 2 % of " Perozid to a 1 % copper solution the action of the Bordeaux mixture, otherwise ineffective, is increased so well as to give the same results as a 1 % Bordeaux mixture. This mixture acted much more vigorously than a Martini mixture containing ½ % copper sulphate and ½ % alum.

8) These experiments (in 1916) have again showed the fungicidal action of " Perozid ", though it is not sufficient if the mildew becomes very serious. In case of mild attack in dry regions it acts satisfactorily on the mildewed leaves at any rate. On the basis of stoïchiometrical calculation about 300 grms of CaO should be added to each kg. of " Perozid " and the sprays made with half this amount of lime were found to be better than those containing the calculated amount of lime. Dusting " Perozid " as a powder over the lower parts of the plants simultaneously with or after spraying the vine stocks was found to be of no utility.

9) The 2 % sulphur lime mixtures with ½ % copper sulphate added

ıave an action proportional to the low copper content; they are found use-
ess against both mildew and " oidium ".

10) The various substances, paste of zinc, salts " Perfluozid " I and
' Perfluozid II ", sulphur lime sprays were insufficiently active, while " Me-
ior, " " Cumullit ", and " Asra " were of no use at all.

195 - **Patents Relating to Means of Prevention and Control of Diseases and Pests of Plants.** — see *Review of Patents*, No. 181 of this *Bulletin*.

196 - **On the Spotting (" Puntatura ") of Wheat Grains.** — LOPRIORE, G., in *Le Stazioni sperimentali agrarie italiane*. Vol. XLIX, No. 7-8, pp. 425-433. Modena, 1916.

In Lombardy, Italy, the name of " puntatura " (spotting) of wheat rains is applied to a condition characterised by a black spot limited to ıe outer face of the cotyledon. According to repeated observations of ıe writer, as well as information he has obtained, the spotting has been ecorded from Molise, in Umbria, in the province of Ferrara, in Germany, ı Sicily and in Basilicata (Campobasso) on a large number of varieties ut with varying intensity (" Carosellone ", " Realforte ", " Ohio ", Scorzonera ", " Triminia ", " Cignarella ", " Bianchetta ", " Carosella ossa ", " Gentil rosso ", etc.) Hard wheats are more liable than soft heats to this affection which appears to be due to the presence of *Cladosporium herbarum*.

The agriculturists of the province of Ferrara, Molise and Sicily, where he spotting is most frequent, do not consider it as injurious. Infected rains are often better samples than normal grains, and in the province of 'errara it is held to indicate perfect maturity. Again, germination tests arried out by PEGLION, D'IPPOLITO and the Author have shown the spot ed grains germinate normally. It remains to be ascertained how the ungus, which does not enter the tissues of the young plant, and causes no isible damage, is finally found close to the germ in the best developed rains.

197 - **A Peronospora Disease of Maize (*Zea Mays*).** — RUTGERS, A. A. L., in *Mededeelingen van het Laboratorium voor Plantenziekten*, No. 22. 30 pp., 7 plates, Batavia, 1916.

Of this disease, known as " Omo Lyer " in the vernacular and caused *Peronospora Maydis* Rac., the writer gives the following summary:

1. The " Lyer " disease is the most serious disease of maize in Java. has been present in Java for at least 25 years and has been found all er Java and Madoera and in Atjeh. It has never been found at an altude of more than 4000 feet.

2. The symptoms of " Lyer " disease are different according to e time of infection. Plants attacked when young, are thin, with narw leaves and quite yellow; when infection has taken place later, the plant developed normally, but the leaves are striped with yellow in a typical anner. Diseased plants of the first type soon wither and die, usually dlapsing; plants of the other type in a few cases even give some ripe eds.

3. The " Lyer " disease is caused by *Peronospora Maydis* Rac. true *Peronospora* and not a *Sclerospora*. The fungus described by RACI-

BORSKI is the same one ; only his figures are rather incorrect. The fungus described by BUTLER, causing a disease with nearly the same symptoms, is not identical, but rightly put in the genus *Sclerospora*.

4. *Peronospora Maydis* Rac. has not only conidia, but chlamydospores and cöspores as well. Both are formed in decaying parts of the young plants, especially in the leaf sheaths.

5. Infection experiments by RACIBORSKI have proved that young plants can be infected by conidia. It is doubtful if this occurs normally in the field, as even plants of the same plant hole do not infect each other as a general rule.

Infection experiments with infected soil gave a negative result. In one case, seed of diseased plants gave diseased plants (4 out of 5 seeds) ; in a second experiment with 50 seeds only healthy plants were obtained.

Soil disinfection experiments with CS_2, NH_3, $KMNO_4$, and formalin gave negative results.

Seed disinfected with hot water (60° C) gave twice as many diseased plants as control seed, probably because the hot water had a weakening effect upon the seed.

198 - ***Verticillium albo-atrum*, Causing the Verticillium Disease of the Potato in Ireland** (1). — PETHYBRIDGE, G. H., in *The Scientific Proceedings of the Royal Dublin Society*, New Series, Vol. 15, No. 7, pp. 63-92, Pl. II-III, Dublin, 1916.

The disease caused by *Verticillium albo-atrum* Reinke and Berthold (Verticillium disease of the potato) is one which results in the more or less premature death of the plant, the general symptoms exhibited being those of a process of gradual desiccation.

The mycelium of the fungus *Verticillium albo-atrum* R. and B. is found in the wood vessels of all parts of affected plants. It passes into the wood vessels of the new tubers, and from these again in the great majority of cases, into the plants which develop from them. Hence the disease is transmitted by means of infected tubers. The fungus in the tuber is not necessarily strictly localized at or near the heel-end, as previous authors (REINKE and BERTHOLD, SPECKERMANN) have supposed.

The fungus grows well in pure culture as a saprophyte, and infection experiments on healthy plants carried out with pure cultures were successful in reproducing the disease.

The disease was, to some extent at least, formerly covered by the terms " Curl " and " Leaf-Roll ", but it is now to be removed from this category and to be regarded as a specific type of those diseases in which the wood vessels become infested with fungus mycelium and for which the general term *hadromycosis* is suggested.

The disease does not appear to be very common in the British Isles and the losses due to it are at present probably not large ; but should it become prevalent, the losses might be severe. The most satisfactory preventive measures are to maintain a proper rotation of crops, and to take steps to ensure that the potatoes used for seed purposes are healthy.

(1) See also *B.*, May 1912, No. 854.

199 - **The Influence of Parasitic Fungi on the Clover Crop.** — Лобикъ А. І. (Lobik, A. I.), in *Болѣзни растеній, вѣстникъ Центральной Фитопатологической Станціи Императорскаго Ботаническаго Сада Петра Великаго* (Diseases of Plants, Bulletin of the Central Phytopathological Station of the Peter the Great Imperial Botanic Garden), No. 4-5, pp. 115-130. Petrograd, 1915.

In 1915, the Department of Agriculture asked the writer to study clover diseases in the Riasan district. The work was started about the middle of May and finished towards the end of August. The facts obtained were worked out at the Central Phytopathological Station of the above Botanic Garden. In a preliminary note, the author gives the results of his work regarding the influence of parasitic fungi on the yield of forage and states that he will complete the work by giving information as to the seed. The work was carried out in six places where clover was grown on a large scale. At each place, plots of 41 to 72 sq. metres were chosen, and in each of the plots a line of 50 to 60 feet of clover was marked in May, that is, when it is usually impossible to observe the development of parasites. Each plant was numbered, enabling individual observations to be kept. The condition of the plant at the beginning of the observations was noted down as well as subsequent observations, such as : 1) the number of stalks ; 2) the number of flower heads per plant ; 3) the number of flower heads per stalk : *a*) the total number ; *b*) the number of infertile flower heads ; *c*) the number of cells attacked by the parasite ; 4) the characters of the stem disease ; 5) the height of the plant. At the end of the work when cutting was being commenced, notes were taken on : 6) the total weight of the plant ; 7) the weight of the flower heads of the plant (when the air is dry). Thus for each plant was known the time when the disease appeared, the rapidity of its development, etc. The degree of development of the disease on stems and leaves was also noted, while taking the area attacked into account when grouping the results.

The seven following parasites were observed during summer on the clover ; *Peronospora Trifoliorum* De By ; *Uromyces Trifolii* (Hedw.) Lev. ; *Erysiphe Polygoni* D. C., *Gloeosporium caulivorum* Kirchn. ; *Phyllacora Trifolii* (Pers) Fckl., *Botrytis anthophila* A. Bond (1) ; *Phyllosticta Trifolii* Rich. At the beginning of June the most advanced parasite was *Gl. caulivorum* ; *U. Trifolii* came up later and *Erys. Polygoni* only developed in August. The other parasites were only observed in isolated cases.

The influence of the parasites on the clover crop gave the following average figures grouped in a table :

From this table it is deduced that if the figures for the plants attacked by *Phyll. Trifolii* and *Erys. Polygoni* are not much different from those for healthy plants, the difference is great when the parasite is *Gl. caulivorum* or *U. Trifolii* : negative in the former and positive in the second. In the first case, even if the disease is not strongly developed, the loss of green matter is very considerable. According to approximate calculations, allowing that the average crop of clover hay should be 36

(1) See *B.* Oct. 1914, No. 955. (*Ed.*)

	Healthy Plants	Plant attacked by *Phyllachora Trifolii*	Plant attacked by *Erysiphe Polygoni*	Plant attacked by *Glossosporium caulivorum*	Plant attacked by *Uromyces Trifolii*		
					leaves slightly attacked	leaves strongly attacked	leaves and stems
Number of stems	7.7	7.2	6.6	8.1	13.2	17.5	12.3
Number of flower heads	23.9	23.2	29.2	13.7	53.8	79.2	65.6
Weight of the plant without flower heads, in grms	7.2	6.2	6.5	4.7	18.1	23.6	15.5
Weight of the flower heads, in grms.	3.5	3.1	4.3	1.4	9.7	17.2	8.9
Weight of a single flower heads, in grms	0.15	0.13	0.15	0.09	0.14	0.2	0.13
Number of plants examined . . .	51	25	48	133	21		

cwt. per acre, that of clover attacked by *Gl. caulivorum* is not more than 21.4 to 23 cwt per acre. Thus the control of this parasite should recive every attention. The figures relating to this fungus are supported by a sufficient number of observations (133) and in consequence, may be considered as approximately true, while for the other parasites, the number of observations is very limited. The figures for *U. Trifolii* have a certain relative value.

The last 3 columns of the table show that all the figures for clover "rust" are higher than those of the healthy plant and that the degree of development of the disease has its effect on that increase. When the leaves are slightly attacked, the figures increase visibly; they are at the maximum when the leaves are badly attacked, and they decrease slightly when both leaves and stems are attacked simultaneously while still remaining higher than the figures for healthy plants. This increase can not be explained by chance and the phenomenon should be thoroughly studied.

According to the writer, the rust appears in June and is fully developed at the end of the same month; the external appearance of diseased plants does not in any way appear different from that of healthy plants until late in autumn when the rust appears plainly. No dead stems or flower heads were ever found on plants attacked by the fungus; no deficient development was even noticed. The attacked plants were actually taller, more bushy and had more abundant flower heads. The proportion of attacked plants was from 8 to 10 per cent; that of badly attacked plants not more than 0.5 to 1.0 per cent., which means that the resulting injury is not worth consideration.

The paper is completed by a list of the weeds in the clover fields of the Riasan Government (including 50 species) and by diagrams showing the increase in weight and dimensions of clover attacked by *U. Trifolii* and *Gl. caulivorum*.

200 - ***Sclerotium Rolfsii*, Injurious to Tobacco, in Deli, Sumatra.** — WESTERDIJK, T., in *Mededeelingen van het Deli Proefstation*, Year 10, Part II, pp. 30-40, Pl. I-II, Medan, 1916.

A new disease of tobacco at Deli (Sumatra) was discovered by the Author in 1914. The theory that the disease was caused by a fungus in the soil was confirmed by experiments which showed that the same disease produced the same effects in certain other plants and also in other countries, like Japan and North America. The parasite was identified as *Sclerotium Rolfsii*.

The disease shows a few weeks after transplanting by the leaves withering and is easily recognised by the white hyphal felt on the roots and the brown, sclerotia, some few millimetres wide. If the roots are not examined, the disease is easily mistaken for a disease caused by *Phytophthora* or certain Bacteria. The same fungus causes a disease of *Hibiscus cannabinus* and *Canavallia* sp. in Java, where the writer found a larger number of leguminosae attacked by *Sclerotium Rolfsii*.

The Author is of the opinion a disease of the sugar-cane, and previously described as " red rot " (" roode rot ") is due to *Sclerotium Rolfsii*.

These researches were confirmed by infection experiments with mycelium obtained from a pure culture of *S. Rolfsii*.

The writer discusses the difficulty of dealing with the parasite buried in the soil and suggests that the only method is to eliminate from the tobacco plantations all plants subject to attack by this *Sclerotium*.

201 - ***Bacterium campestre* Injurious to Crucifers Cultivated in South Africa.** — DODGE, E. M., in *The South African Journal of Science*, Vol. XII, No. 10, pp. 401-409, fig. 1-3, Pl. 8-11. Cape Town, 1916.

The Author has recorded *Bacterium campestre* (Pam.) Sm., as occurring in South Africa. For several years cultivated crucifers were often observed to be suffering from a disease similar to that produced by this bacterium and described by ERWIN F. SMITH under the name of " black rot of cruciferous plants ", which he considered as only occurring in Europe, America, and New Zealand.

The writer has identified the cause of the disease, and has found that the organism is very common in South Africa. It attacks cabbage, cauliflower, kohl-rabi and swedes. Thebacterium has been isolated from diseased tissues and a number of successful inoculations have been made with pure cultures. The organism was found on imported seed offered for sale in Pretoria, its presence being proved by inoculations. A summary of the characters of the South African organism is given by the writer, and they are found to correspond with those of *B. campestre*.

It is suggested that, as a precautionary measure, all seed of cruciferous plants be disinfected before planting by immersing for 15 minutes in formalin (1 : 240) or in corrosive sublimate (1 : 1000)

202 - ***Botrytis cinerea*, a Disease Attacking the Shoots and "Fruit" of Fig Trees in England.** — BRIERLEY, WILLIAM B. in *Royal Botanic Gardens Kew, Bulletin of Miscellaneous Information*, No. 9, pp. 225-229. Pl. VIII-IX. London, 1916.

When examining a number of fig trees growing in a garden at Mortlake, it was noted that those which showed much "fruit" affected by rot due to *Botrytis cinerea* Pers. were also affected with a die-back of the young green shoots, whilst this was practically absent from trees bearing healthy "fruit". On the dead shoots were pustules of *Botrytis* conidiophores.

Botrytis conidia were transferred by means of a penknife blade to the apical pore of 6 figs of almost mature size. Of these, 3 were inoculated with spores from a dead shoot, and 3 from spores from a diseased "fruit". The conidia were placed in the pore which was dry, and care was taken to avoid injury. A fortnight later, all the inoculated figs were diseased, whilst no others on the same tree were found affected.

In a similar manner, spores were transferred from diseased figs and dead shoots, to living shoots and placed in excisions made in the twig, in leaf axils, and in the apical bud. Other shoots were similarly cut, but not inoculated, to remain as checks. In every case where the spores were inserted in a wound, the shoots were killed and pustules of *Botrytis* conidiophores were formed. On the other hand, shoots which had been merely wounded, or inoculated on unwounded surfaces, remained perfectly healthy

The experimental figs and shoots were examined, and with the exception of one shoot, *Botrytis* mycelium only was present in the tissues. The one exception gave rise to the fructifications of a species of *Tubercularia*.

Subsequently a large series of inoculation experiments with pure cultures of the *Botrytis* derived from Southampton and Mortlake were commenced; the results already obtained confirm those of the preliminary experiments.

After having described the growth of the fungus in pure culture, the writer gives an account of the course of the disease in the figs and shoots.

Infection may occur at any point, but usually the attack commences at the pore, and thence spreads rapidly till the entire "fruit" is enveloped in a grey mould of *Botrytis* conidiophores. During this time, the tissues of the fig undergo marked alterations in texture and colour, though the central cavity is usually free from mycelium. By the time the fig is completely enveloped, it has shrunk considerably in size and after a few weeks shrivels to a mummified condition. In this state it often hangs on the tree during the winter, and in early summer, gives rise to abundant conidiophores.

Conidia taken from such "mummies" which had over wintered on the tree, proved readily capable of reproducing the disease on both healthy shoots and figs.

When a shoot is inoculated, the mycelium at first tends to spread equally in all directions and rapidly encircles the shoot. It then slowly progresses upwards in the tissues and more rapidly downwards. The shoot above the diseased area soon dies and usually becomes shrivelled and brown. The growth of the mycelium seems to be confined to the one season, so that it does not advance from the dead shoot further into the tree the following

year. The mycelium is chiefly found in the cortex of the shoots and the hyphae penetrate the tissues rapidly in all directions. They do not appear to exert the same destructive action upon the cell walls as was noted in the fruit, but the cells are killed and collapse.

In certain of the shoots the fungus remains alive during the winter, and gives rise to successive crops of conidia the following year. Such conidia are capable of reproducing the disease when inoculated into shoots and figs.

It is evident that the fungus is carried over the winter in the mummified "fruits" and dead shoots, and therefore these two sources of infection should be carefully eliminated. Badly infected trees which have been so treated have entirely recovered and now bear healthy and full crops.

203 - **On the Black Rot ("Nerume" or "Marciume nero") of Chestnuts, in Italy.** — PEYRONEL, BENJAMIN, in *Rendiconti della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, Series 5, 1916, 2nd Half-year, Vol. XV, Part II, pp. 459-461. Rome, 1916.

The preservation of chestnuts is often seriously hampered by the production of a sooty black colour on the whole or part of the cotyledons of the achene, whence the names "nerume" (= blackness) or "marciume nero" (= black rot) given in Italy to this condition. The attacked chestnuts which then acquire a bad taste and become quite uneetable, cannot be distinguished externally from healthy ones : the shell (pericarp) is often intact and of normal colour.

In Italy, PEGLION (1905-1906) found in attacked fruits a mycelium relating to *Rhacodium cellare* Pers., from which, after cultivation on various artificial media, he obtained abundant conidia resembling the fructifications of *Cladosporium*, *Hormodendron*, *Cladotrichum*, etc. BAINIER (1908), in France, has obtained, on the contrary, from pure cultures on sterilised chestnuts and on liquorice, the same characters as those described by PEGLION ; but which after a couple of weeks, gave rise to a conidial form with no morphological affinity whatever with *Cladosporium*, *Hormodendron*, etc., and called by him *Harziella Castaneae* ; this species, according to the writer, should be transferred, because of the type of its mycelium, from the family *Mucedineae*, to which the genus *Harziella* belongs, to that of the *Dematieae* and classed under a new genus, probably close to the genus *Stachylidium*.

Because of the differences of opinion between PEGLION and BAINIER regards the conidial form, the writer first enquires if there is a single causal agent and whether the fungus studied by BAINIER is the same as that observed by PEGLION. In addition, without denying that storing chestnuts in cellars or damp warehouses, facilitates the development of the disease, the writer — from observations made in the vaudois valleys (Piedmont) — doubts that the infection really starts in those places, as PEGLION thinks.

As regards the entrance of the fungus into the fruit, since the pericarp is usually intact, it seems justifiable to suppose that infection takes place at the tip of the fruit, where lesions show more easily. But on cutting chest-

nuts not completely attacked by the fungus, it is at once seen that the alterations are produced on any part of the fruit.

If it is allowed that the fungus cannot penetrate the pericarp — a phenomenon as yet unexplained and which the writer considers improbable — it just be supposed that infection takes place at flowering when the fungus spores penetrate the ovary by way of the stigma, producing a fine mycelium which then develops in the ripe fruit, provided that latter is kept under the requisite conditions of moisture and temperature.

The Author, who is continuing the study of this disease, has obtained pure cultures on different media, with abundant production of mycelium which, at first silver-white, becomes grey, and finally olive colour; up to the present, however, these cultures have produced no fructification whatever.

WEEDS AND PARASITIC FLOWERING PLANTS.

204 - ***Emex australis*, a Queensland Weed.** — BAILEY, T. F. and WHITE, C. T., in *Queensland Agricultural Journal*, Vol. VI, Part 6, pp. 373-374, Pl. 41. Brisbane, 1916.

The polygonaceous plant *Emex australis* is spreading considerably. The plant, originating from South Africa, is mentioned by BENTHAM in his " Flora australiensis ", but with doubt, as a native of southern and western Australia; in fact, it occurs in all the eastern states. As far as Queensland is concerned, it was first recorded in 1911 as naturalised near St-George.

The authors describe the weed, giving the different popular names: " Cape Spinach ", " Spiny Emex ", " Goathead Burr ", " Three-cornered Jack ", " Cats, Heads " " Cape Dubbeltje-Doorn", " Cape Devils' Thorn", etc.

ANDREW SMITH, in his work on the medicinal plants of Cape Colony, notes the therapeutic properties of the leaves of *Emex australis*. The destruction of the plant should, as with all annuals, take place before the formation of seed.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

205 - **Insects and Other Enemies of Cultivated Plants, Observed in Ireland during 1914 and 1915** (1): — CARPENTER, GEORGE H., in *The Economic Proceedings of the Royal Dublin Society*, Vol. II, No. 12, pp. 221-237, Fig. 1-8, Pl. XIV-XVII. Dublin, 1916.

CULTIVATED CRUCIFERS — Diamond-back Moth (*Plutella maculipennis* Curtis = *cruciferarum* Zell.), very injurious to white turnips and swedes; Turnip Moth (*Agrotis segetum* L.) damaged cabbages and turnips; Cabbage Fly (*Phorbia brassicae* Bouché) attacking radishes.

CORN. — Oat Aphid (*Aphis avenae* Fab.).

(1) See also *B. Jan:* 1914, No. 86.

POTATOES. — Potato Aphid (*Rhopalosiphum solani* Theobald); Black-fly grubs (*Bibio* sp.) ; Rosy Rustic Moth (*Hydroecia micacea* Esp.).

MANGEL. — Carrion Beetle (*Silpha opaca* L.) ; Brassy Flea-beetle (*Plectroscelis concinna* Marsh), a new pest of the plant.

CELERY. — Green Leaf Beetle (*Phaedon tumidulus* Germ) ; Carrot Fly (*Psila rosae* Fab.) .

CARROTS. — Carrot Fly (*Psila rosae* Fab.).

FLAX. — Flax Flea-beetle (*Longitarsus parvulus* Payk.).

TOBACCO. — Heart and-Dart Moth (*Agrotis segetum* Schiff. and *A. exclamationis* Linn.)

FRUIT TREES. — Shield Bugs (*Tropicoris rufipes* Linn. and *Palomena prasina* Linn.) ; Plum Aphid (*Aphis pruni* Réaumur) ; Garden Chafer (*Phyllopertha horticola* Linn.) ; Clay-coloured Weevil (*Otiorrhynchus picipes* Fab.) ; Eyed Hawk Moth (*Smerinthus ocellatus* Linn.) ; Apple Leaf-miner (*Lyonetia clerckella* Linn.) ; *Bibio* sp., injuring apple trees;.

ORNAMENTAL PLANTS. — Root Mites (*Rhizoglyphus echinopus* Furn. and Rob.) ; White Springtails (*Isotoma tenella* Linn.) ; Green Leaf Weevil (*Phyllobius viridiaeris* Laich) on climbing roses ; Black Vine Weevil (*Otiorrhynchus sulcatus* Fab.) on ferns ; Winter Moth (*Cheimatobia brumata* Linn.) on Rhododendron leaves ; Swift Moths (*Hepialus* sp.) on tulip bulbs.

TREES. — Hazel Larch and Leaf Weevils (*Strophosomus coryli* Fab., and *Phyllobius argentatus* Linn.)

206 - **The Effect of Hydrocyanic Gas Fumigation on the Eggs of *Aphis pomi* and *A. avenae*, Apple Parasites, in Ontario.** — ROSS, W. A., in *The Canadian Entomologist*, Vol. XLVIII, No. 11, p. 367. London, 1916.

The fumigation of young apple trees with hydrocyanic acid gas just before or shortly after the buds commence to swell not only controls the San José scale (*Aonidiella perniciosa* = *Aspidiotus perniciosus*) but it also destroys the eggs of aphids.

In the spring of 1914 out of seven apple trees obtained from a nursery and well stocked with eggs of *Aphis pomi* and *A. avenae*, three were fumigated with hydrocyanic acid gas (1 oz. KCN to 100 cu. ft., 1 :1 :3 formula) for 45 minutes and the others used as controls. None of the eggs on the fumigated stock hatched, whereas large numbers hatched on the control trees.

The experiment was repeated in the spring of 1916, and the same satisfactory results were obtained — 100 per cent of the aphis eggs were destroyed.

In 1914 and in 1916, the nursery stock was fumigated 8 days and 6 days respectively before the eggs on the control trees commenced to hatch.

207 - **On the Injury to Rice called "Hielo", in the Villavicencio Region, Republic of Columbia.** — DAWE, M. T., in *Revista Agricola*, Year II, No. 6, pp. 327-330. Bogota, 1916.

Although it has nothing to do with frost, there is a disease of rice called "hielo" at Villavicencio, in which region it has been known for over ten years. But, in 1916 it became more serious.

It is primarily characterised by longitudinal streaks appearing on the leaves and which become more and more evident until the attacked parts dry up and tear. Finally, the leaves rot and droop. The attack is not always general. The same phenomenon has also been noted in maize and probably other graminae are also attacked.

The writer has shown that the injury to rice in the above region is caused by a small insect which sucks the juices of the leaves. Weakly plants grown on unsuitable soil, give way more easily to attack, while climatic changes may render the plants more susceptible.

The growth of rice and maize together, as practised in this region, favours the disease as maize is also attacked by the insect. Insufficient or bad preparation of the soil results in the production of weakly plants, which cannot support the loss caused by the insect. In the region over which these resarches were made, the rice is grown under what is called "dry" culture. It is probable that, in a region like that of Llanos, near to a mountainous district, having abundant water, and soil naturally suitable for irrigation; the growth of aquatic varieties would give better results.

As a means of control of this pest, the Author advises the use of spraying with a petroleum emulsion.

208 - **Sunflower (*Helianthus annuus*) Roots Deformed by a *Heterodera*, at Porto Tolle, Italy.** — See No. 189 of this *Bulletin*.

209 - ***Tortrix oleraceana* n. sp., a Microlepidopteron Injurious to Cabbages in Newfoundland, N. America.** — GIBSON, ARTHUR, in *The Canadian Entomologist*, Vol. XLVIII, No. 11, pp. 373-375, Pl. X. London, 1916

In July 1915, in some farms near St. Johns' a large number of small tortrix caterpillars were noticed infesting cabbage leaves. In one farm, they completely destroyed the first planting and a large part of the second.

On breeding out the larvae, it was found that it was not the European species *Tortrix wahlbomiana* L. var. *virgaureana* Tr. — although the latter insect has much affinity with that under discussion — and similarly it was not identical with any of those species described for North America. So the Author proposes the name of *T. oleraceana* n. sp., for the insect which he also describes systematically. During 1916, this insect has caused severe injury in Newfoundland; caterpillars sent have proved, on breeding out, to belong to the new species in question.

210 - **The Olive Fly (*Dacus oleae* var. *asiatica* n. var.) and One of its Parasites Recorded for the First Time in India.** — SILVESTRI, F., in *Rendiconti della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, Series 5, 1916, 2nd Half-Year, Vol. XXV, Part II, pp. 424-427, 1 Fig. Rome, 1916.

The Author who, being firmly convinced that the olive fly and its parasites are present in N. W. India, had requested the entomologist MR. T. B. FLETCHER to obtain information on this subject — was informed by MR. FLETCHER that he had collected worm-eaten fruits at Cherat belonging probably to *Olea cuspidata*, from which he had obtained adults of *Dacus oleae* and of an *Opius* parasitic on the former.

After examining the material, the Author discusses and describes specimens of *Dacus oleae* from India as simply representing a new variety (var. *asiatica*) of the type form and the parasite as a new species of *Opius* (*O. bonerophagus*). In his collection, the Author also has specimens of *Dacus oleae* from Beyrouth (Syria) obtained from fruits of *Olea europea* which closely resemble those from India in colour.

The new *Opius* is very close to *O. concolor* Szèpl. and *O. dacicida* Silv.

211 - ***Notarcha* (*Nacoleia*) *octasema*, a Microlepidopteron Injurious to the Banana, in Java.** — LEEFMANS, S., in *Mededeelingen van het Laboratorium voor Plantenziekten*, No. 23, 23 pp., 5 Pl. Batavia, 1916.

Everywhere where bananas are grown in Java the writer has noticed that the fruits are infected, the skin becoming scabby. The damage is usually confined to the skin, but the insects sometimes gnaw the fruits so badly that the interior becomes rotted, thus causing a considerable loss of crop. The scabby fruits cannot be exported, for the Australian importers refuse to accept damaged fruits.

The insect causing the damage (*Notarcha* [*Nacoleia*] *octasema* Meyr) is well known in the New Hebrides, Solomon Islands and Queensland. The insect probably lays its eggs on the flower bracts. After four days, the eggs hatch and the larvae, 1.5 mm. long, proceed towards the fruit. The writer has rarely found the chrysalids between the fruits and he thinks that they are usually to be found among fallen leaves or between the base of the leaves and the stem. The larvae are mature in 11 days, and three days later the cocoon is commenced and eight days after, the adult emerges from the cocoon. The insect requires 30 days for its development in a rainy season, while in a dry season 27 days suffice.

They fly by night, remaining concealed during the day.

A braconid, probably belonging to the genus *Apanteles*, has been found to be a parasite of the larvae. These parasites are not numerous and are not of much importance in controlling *Notarcha*.

The writer's attention was drawn to a method for controlling a similar banana pest in the Fiji Islands by a Java exporter. The method consists in powdering the fruits with a one-in-three mixture of pyrethrum and wood-ash. A few tests with other insecticides as well as with the ash gave unsatisfactory results. The best method of applying the mixtutre of pyrethrum powder and wood ash is to blow the powder on the fruits with a syringe introduced between the bracts as soon as the inflorescence commences to develop and while the bracts still cover the fruits. 3 grammes of pyrethrum are sufficient for the two treatments, which according to the writer costs 12 centimes per inflorescence in Java The wood ash may be replaced by powdered lime for mixing with the pyrethrum.

212 - ***Alcides frenatus*, a Coleopteron Injurious to the Mangotree, in Bengal.** — SEN, P. C., in *Agricultural Department, Bengal, Leaflet* No. 2 of 1916.

The larvae of *Alcides frenatus* Fst (" mango shoot-borer ") cause severe injury to the mango-trees, especially those that are grafted. It bores galleries in the young shoots. Each year from March to December

serious damage is observed in the Dacca Botanic Garden. The insect also occurs in other localities. When new shoots are formed it is advisable to examine them occasionally and if the adult insect is seen, measures should be taken for its destruction. As far as is possible all shoots containing eggs or larvae should be destroyed. If these measures are carried out from the very first, the damage will be notably reduced.

213 - **Scale Insects as Vine Pests and their Relationships with other Cultivated Plants.** — JABLONOWSKII J., en *Kisérletügyi Közlemények (Communications from the Experimental Stations of Hungary)*, Vol. XIX, No. 2, pp. 169-285, 31 fig. (From the German summary pp. 286-288). Budapest, 1916.

Scale insects in the Hungarian wine-growing zones have hitherto been of the same importance as in other countries. The situation, however, in Hungary, has been worsened by the fact that the new plains vineyards either on loose sand exempt from phylloxera or on clayey soil, are drawing nearer and nearer to the Robinia plantations which are very seriously attacked by the Coccid *Eulecanium corni* (Bché) var. *robiniarum* (Dougl.) March. (or formerly simply *Lecanium robiniarum* Dougl.). Through the agency of these Robinias the Coccid is carried to the vine. The writer remarks in this connection that the vine considered as plant host, has no particular species of Coccid of its own ; in other words no species of scale insect exists whose existence is intimately connected with that of the vine. The Coccids of the vine are mostly occasional pests which live on a great many other plants from whence they may spread to the vine. After a general discussion of the data relative to this question and a brief description of the scale insects recorded as parasitic on the vine, the writer considers the following 6 species which have either been introduced or may be introduced into Hungary as pests of the vine.

Phenacoccus aceris (Sig.) observed on the vine, but only very rarely, is common and often present in large numbers in Hungary, in the scars of old wounds on maples, wild chestnuts and fruit trees (especially apple). From the agricultural point of view this scale is of no importance.

Pseudococcus adonidum (L.) = *Ps. longispinus* Targ. Tozz., is a pest of conservatory and hot-house plants ; it may attack hot-house vines but so far has not been found in Hungary as a field pest.

Pseudococcus citri (Risso) = *Ps. brevispinus* Targ. Tozz., is an injurious insect both in conservatory and field. This is the famous species known under the names of *Coccus vitis*, *Dactylopius vitis* Nedzelsky; it is the primary cause of the " phthiriasis " familiar in Eastern history and of the disease of the vine recently described as the " Jaffa disease ". This species is indigenous to Hungary but is not an exclusive pest of the vine, it frequents other plants, passing the winter upon them. Experiments show that there is no fear of its injuring the vines.

Pulvinaria betulae (L.). often wrongly designated as *Lecanium vitis*, is frequently present, often in large quantities, upon long pruned vine canes which, owing to the presence of old wood, are more seriously endangered than would otherwise be the case. Vine trellises and espaliers, at the

beginning of June, are perfectly white as a result of the presence of this insect.

Eulecanium corni (Bché) var. *robiniarum* (Dougl.) March., infests Robinias throughout Hungary and often occurs on isolated trees in masses of surprising size, or in avenues or woods of Robinia whence it easily passes to the vine. During their autumn and spring migrations, the young Coccids may easily be carried by the wind and so reach the vine or other plants. Cases are cited where these scale insects have been able to attain their complete development in potato or hemp fields, on the foliage of sugar beets and on a great number of weeds.

Eulecanium persicae often wrongly termed *Lec. vini* Bouché, and which is generally admitted to be a southern representative of the genus, also occurs in Hungary on the vine and in analogous circumstances to the species mentioned above. Long pruning also favours their increase, the more old wood present, the greater the number of scale insects. The two species of coccids just named have the disadvantage of retarding the formation of spring shoots. On the other hand, where spring frosts occur, this may not be without corresponding advantages. The emission of honeydew in large quantities in summer weakens the development of the grapes; "fumago" spoils the quality of the table grape (grapes covered with "fumago" are useless); whilst the crust of "fumago" on the upper surface of the leaves, and the attacks of the young Coccids on the branches, in August and September, hinder the formation of sugar in the grapes.

Short pruning effected annually, results in spring in a great reduction in the number of larvae which have survived the winter. It is thus the best natural means of control. As regards other methods the writer only recommends that of destroying by crushing the big mother scales with their contents immediately after egg-laying. Mere brushing, especially when carried out late, has serious drawbacks. Although the mother and a small portion of the unlaid eggs may be destroyed, yet the majority of eggs, being on the ground, remain unharmed and may give rise to a number of larvae which will lead to a recurrence of trouble the following year. With regard to spraying on the one hand it is impossible to get at these insects sufficiently well by this method, and, on the other hand, the liquid hitherto employed (carbolineum, strong petroleum emulsions) is not only harmful to the canes, in winter, but often directly fatal.

ALFREDO RUGGERI, *gerente responsabile*.